August 21, 1961

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Aviation Week and Space Technology

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Self-Focusing Antenna Arrays Are Developed

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ANOTHER ASPECT OF THE MARQUARDT MISSION

ELECTRIC PROPULSION

Sustained space travel, free from gravitation in a natural vacuum, presents new and difficult problems in the propulsion and control of space vehicles. Electric propulsion promises a practical and economical means of accomplishing space exploration programs.

The three main types of electric engines, while varying in performance specifications, share common advantages over chemical engines. The electrothermal, electromagnetic, and electrostatic engines offer specific impulses greater than 1,000 seconds and thrust durations measured in weeks to months. As a result, electric propulsion systems have the capacity to deliver much larger payloads over longer distances than will conventional rockets. Power for these electric engines can be drawn either from nuclear energy sources built into the vehicle or from solar radiation.

The Marquardt Corporation — long a leader in the field of propulsion — is intensively engaged in a variety of unique electric propulsion projects. An example in the electrothermal area is the Resistojet. Here the hydrogen propellant passes over an electrically heated resistance element prior to expansion in a deLaval nozzle. The Resistojet provides reliability, long life, direct coupling to the power supply, hig efficiency, a simple starting cycle, and throttleability.

The Marquardt Corporation's efforts in the space propulsio and control fields serve to typify yet another aspect of th Marquardt Mission.

Creative engineers and scientists are needed. All qualifie applicants will receive consideration regardless of rac creed, color, or national origin.

THE Marquardt
CORPORATION
CORPORATE OFFICES, VAN NUYS, CALIFORNIA

AVIATION CALENDAR

Aug. 26—Federal Aviation Agency's Second Hangar Flying Meeting, Holman Field, Minneapolis-St. Paul, Minn.

Aug. 28-30—West Coast Conference of Applied Mechanics, University of Washington, Seattle, Wash.

Aug. 28-30—Air Force/Aerospace Corp.'s Symposium on Ballistic Missile and Aerospace Technology, University of Southern California, Los Angeles, Calif.

Aug. 28-Sept. 1—International Heat Transfer Conference, University of Colorado, Boulder, Colo.

Aug. 28-Sept. 1—Third International Symposium on Rockets and Astronautics, Japanese Rocket Society, Tokyo, Japan.

Aug. 30-Sept. 1—Second Annual Bionics Symposium, General Electric Advanced Electronics Center, Cornell University, Ithaca, N. Y.

Aug. 30-Sept. 1—Third Annual Semiconductor Conference, American Institute of Mining, Metallurgical and Petroleum Engineers, Ambassador Hotel, Los Angeles.

Sept. 4-10—1961 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.

Sept. 4-14—Eighth Anglo-American Aeronautical Conference, Royal Aeronautical Society and Institute of the Aerospace Sciences, London, England. Wilbur Wright Memorial Lecture, Sept. 12.

Sept. 5-8—16th National Conference, Assn. for Computing Machinery and First International Data Processing Exhibit, Statler-Hilton Hotel, Los Angeles, Calif.

(*Continued on page 6*)

AVIATION WEEK and Space Technology

August 21, 1961

Vol. 75, No. 8

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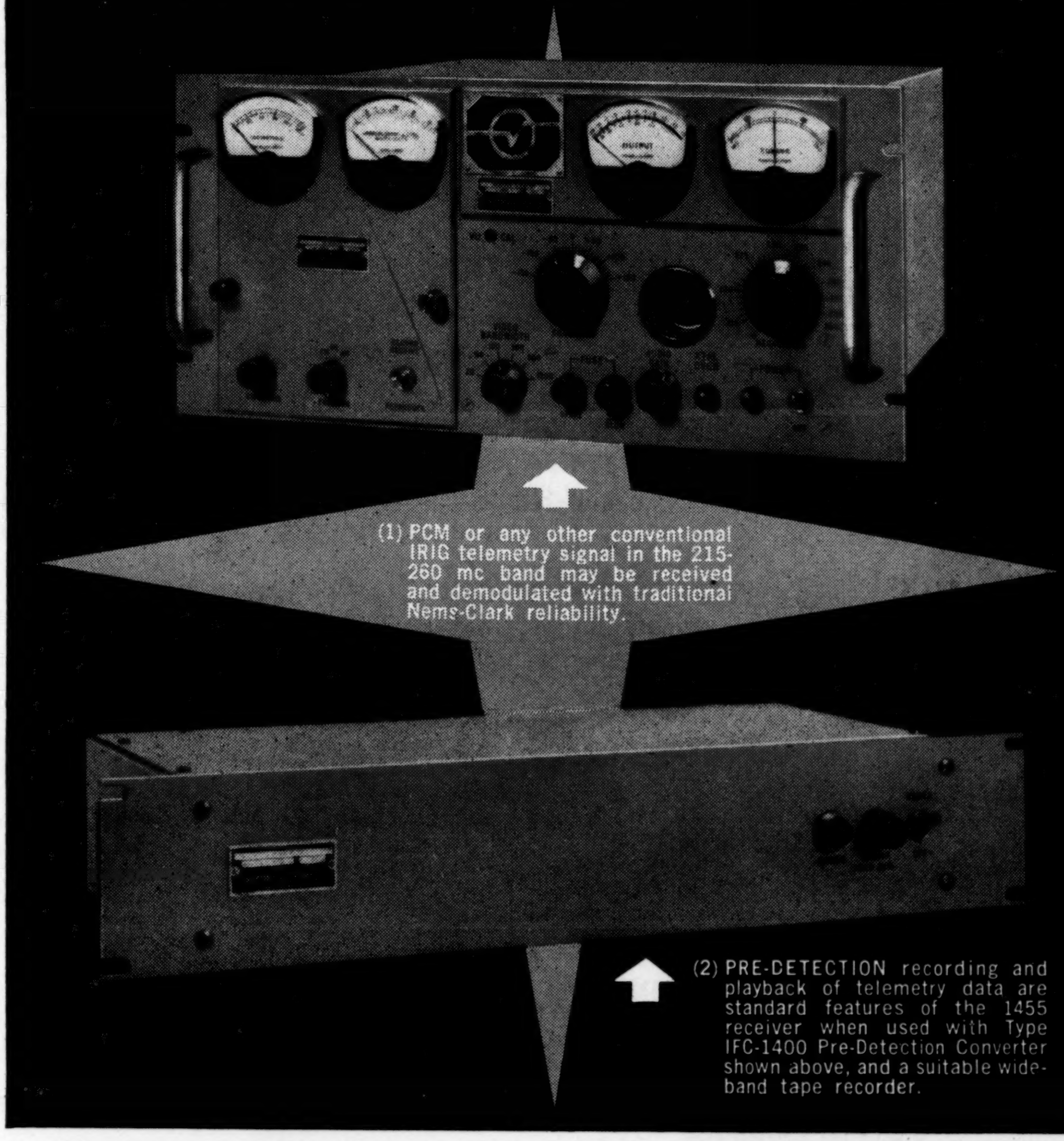
MULTIPLE BANDWIDTH TELEMETRY RECEIVER NEMS-CLARKE 1455



(1) PCM or any other conventional IRIG telemetry signal in the 215-260 mc band may be received and demodulated with traditional Nems-Clark reliability.

(2) PRE-DETECTION recording and playback of telemetry data are standard features of the 1455 receiver when used with Type IFC-1400 Pre-Detection Converter shown above, and a suitable wide-band tape recorder.

The ease and speed of changes in IF bandwidth, and interchangeability of modules, makes this receiver the most versatile of Nems-Clarke 1400 series telemetry receivers.

This receiver is unique because it offers a variety of plug-in IF demodulator modules which plug into front panel to determine operating IF bandwidth of receiver. Each module is interchangeable with the others without disturbing the level adjustments of receiver, since each module provides output voltages and meter deflections of essentially the same percentage of bandwidth. Thus, one basic receiver chassis serves to cover bandwidth ranges from 30 kc to 1.5 mc in nine separate bandwidths.

Pre-Detection Feature—In addition to the usual standard outputs for connection to auxiliary equipments (such as signal strength, video frequency response, frequency monitor and spectrum display), this receiver has a 5 mc pre-detection recording output and playback input. When the output is connected to a Pre-Detection Converter, Nems-Clarke Type IFC-1400, and a recorder, telemetry data can be recorded prior to demodulation and stored for subsequent playback and demodulation.

Modules for the receiver may be obtainable separately as required in the following IF bandwidths: 30, 50, 100, 200, 300, 500, 750 kc; 1.0 and 1.5 mc.

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AVIATION CALENDAR

(Continued from page 5)

Sept. 5-8—Fourth Annual Scientific Meeting Flying Physicians Assn., Holliday Hotel, Reno, Nev.

Sept. 6-8—National Symposium on Space Electronics and Telemetry, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.

Sept. 6-8—Joint Nuclear Instrumentation Symposium, North Carolina State College, Raleigh, N. C. Sponsors: American Institute of Electrical Engineers; Instrument Society of America; IRE.

Sept. 7-8—Fall Meeting, Western States Section/The Combustion Institute, University of California, Berkeley, Calif.

Sept. 10-12—National Convention, National Aeronautic Assn., Westbury, N. Y.

Sept. 13-14—International Operations and Maintenance Symposium, Airwork Corp., Millville, N. J.

Sept. 13-15—16th Annual Meeting, Armed Forces Chemical Assn., Statler-Hilton Hotel, Washington, D. C.

Sept. 14-15—Ninth Annual Joint Societies Engineering and Management Conference, IRE, Hotel Roosevelt, New York.

Sept. 14-15—Conference on Technical-Scientific Communications, Institute of Radio Engineers, Bellevue-Stratford Hotel, Philadelphia, Pa.

Sept. 15-17—Annual Convention, National Assn. of State Aviation Officials, Miami Beach, Fla.

Sept. 20-21—Industrial Electronics Symposium, Institute of Radio Engineers, Bradford Hotel, Boston, Mass.

Sept. 20-24—National Convention and Aerospace Panorama, Air Force Assn., Philadelphia, Pa.

Sept. 26-28—Annual Convention, National Business Aircraft Assn., Mayo Hotel, Tulsa, Okla.

Sept. 29-30—Society of Experimental Test Pilots' Fifth Annual Symposium and Awards Banquet, Beverly-Hilton Hotel, Beverly Hills, Calif.

Oct. 2-4—Seventh National Communications Symposium, Institute of Radio Engineers, Hotel Utica, Utica, N. Y.

Oct. 2-7—12th International Astronautical Congress, Washington, D. C.

Oct. 3-5—National Airports Conference, University of Oklahoma, Norman, Okla.

Oct. 9-13—National Aerospace Engineering & Manufacturing Meeting, Society of Automotive Engineers, Ambassador Hotel, Los Angeles, Calif.

Oct. 9-15—American Rocket Society's 16th Annual Meeting & Space Flight Report to the Nation, Coliseum, New York, N. Y.

Oct. 14-22—Federation Aeronautique Internationale 1961 General Conference, Hotel Quintandinha, Rio de Janeiro, Brazil.

Oct. 19—General Aviation Safety Committee, National Safety Council, Conrad Hilton Hotel, Chicago, Ill.

Oct. 23-24—Joint Meeting, Canadian Aeronautical Institute/Institute of the Aerospace Sciences, Ottawa, Canada.

Oct. 23-27—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.

Oct. 24-26—International Symposium on Aero-Space Nuclear Propulsion, Institute of Radio Engineers, Riviera Hotel, Las Vegas, Nev.

August 21, 1961

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and Space Technology

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▶ Maximum revenue production from jet fleet and tight cost control cited by airline as reasons for 1960 profit.

Self-Focusing Antenna Arrays Developed.......... 54

▶ Adaptive antenna array is capable of quickly seeking, locking onto, and then automatically tracking a signal source.

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The NASA AT&T Contract.......... 21

COVER: Giant radome for USAF's Haystack Hill radio facility is nearing completion at Tyngsboro, Mass. Radome will have extensive application to recently approved Project West Ford (see p. 31), which is intended to reflect electromagnetic radiation from tiny dipoles placed in a belt around the earth. Radome, consisting of 96 panels of ½-in. thick aluminum honeycomb, will be 150 ft. across at its widest point and 134 ft. high. It was designed by Lincoln Laboratory of Massachusetts Institute of Technology and is being built by H. I. Thompson Fiber Glass Co. A 120-ft. parabolic antenna, developed by North American Aviation, Columbus Division will be erected within the radome.

PICTURE CREDITS

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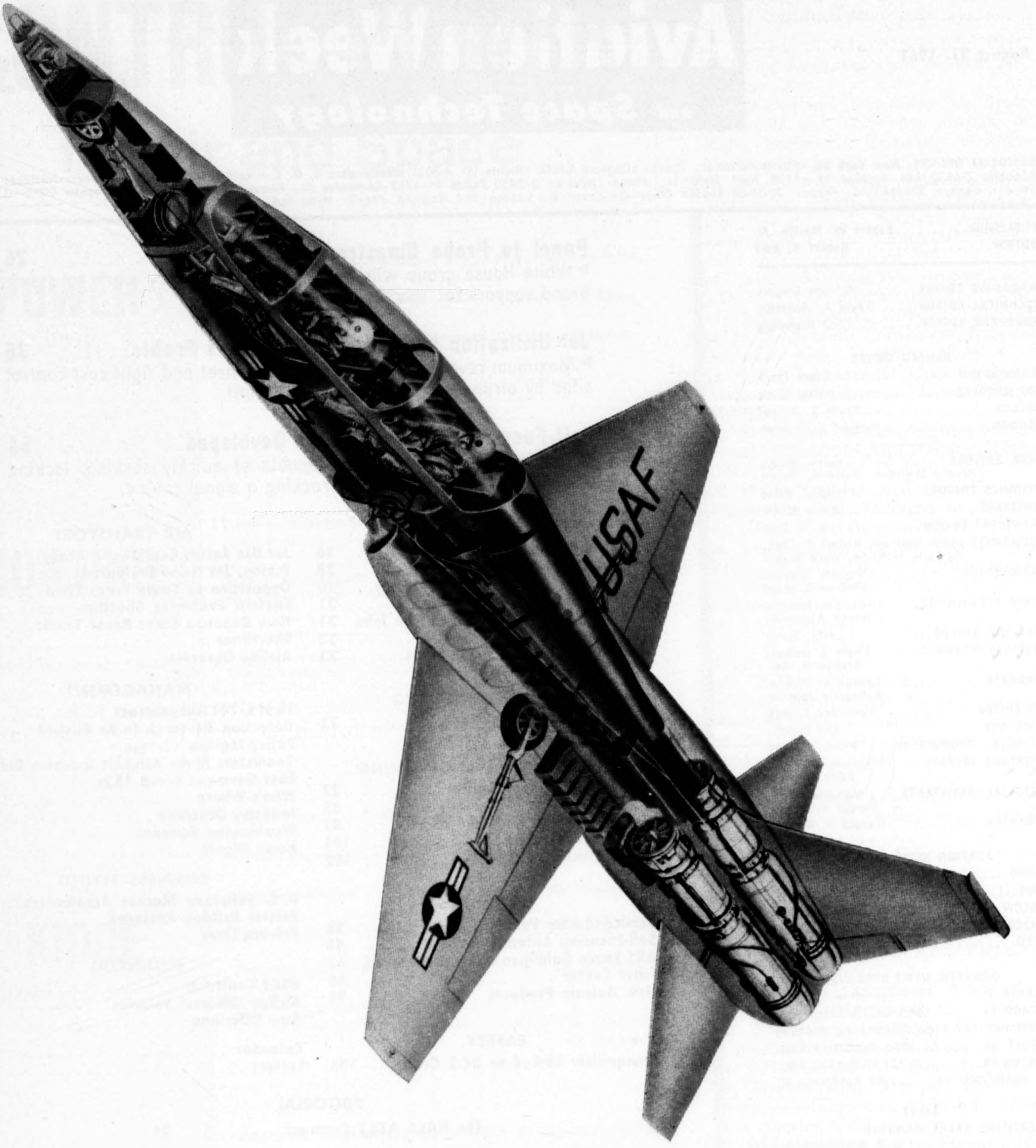


BFG FUEL CELLS FIT T-38 LIKE A GLOVE TO INCREASE RANGE

To maximize the capacity of the five internal fuel cells of the Northrop T-38, every bit of available space has to be utilized. Thus B.F.Goodrich builds the cells in a complex configuration—rather than the usual flat surface—to fit around structural members and other equipment.

These BFG cells are produced to very close tolerances to provide a fuel-tight system with proper fit. This close quality control has simplified Northrop's assembly operations. And as an added bonus, BFG developed a new fitting which reduces over-all fuel cell weight.

B.F.Goodrich maintains complete fuel cell test and development facilities . . . and has extensive experience in design and production of cells for aircraft, missiles, and ground vehicles. For complete information contact B.F.Goodrich Aerospace and Defense Products, a division of The B.F.Goodrich Company, Dept. AW-8B, Akron, Ohio.

B.F.Goodrich aerospace and defense products

EDITORIAL

The NASA-AT&T Contract

National Aeronautics and Space Administration has signed a highly unusual agreement with the American Telephone & Telegraph Co. for the launching of experimental communication satellites. Because of the great interest this has aroused in government and in the communications and aerospace industries, Aviation Week *is publishing the statement made recently by NASA Administrator James E. Webb before the House Science and Astronautics Committee, which is the most complete explanation of the philosophy behind the contract that has been given by the government to date.*

When I appeared before this committee earlier to discuss the work of the National Aeronautics and Space Administration in the field of communication satellites, we had not at the time concluded a cooperative agreement with American Telephone & Telegraph Co. We have now done so, and I am therefore able to discuss that agreement with you. . .

The American Telephone & Telegraph Co. will design and build communication satellites, at its own expense, for two launchings during 1962. NASA will provide the launch vehicles and the facilities for launching and tracking and will be reimbursed by AT&T.

These arrangements with AT&T will add greatly to the total program of experimentation in active satellite communications and will assist in the development of relationships between government and industry which are necessary to accelerate the early realization of an operational system.

The agreement with AT&T has been made in a manner which will avoid putting AT&T in a preferential position in relation to other interested companies, which may, in the future, have an interest in the operation of a communication satellite system or supplying equipment to the operator of such a system.

In the first place, the project is recognized by both parties as entirely experimental. This means that it does not involve any commitment with respect to any operational undertaking or any particular design of operational satellites.

Secondly, a full report of the experimental results achieved by AT&T will be made to NASA and thereby the government will be in a position to apply the results obtained for the benefit of any authorized commercial undertaking pursuant to future action by the Federal Communications Commission.

In the third place, we have made very specific arrangements concerning patentable inventions. There may be inventions made in the course of the "work performed under or in anticipation of this agreement." As to these, the government will have a royalty-free license for the practice of such inventions throughout the world by or on behalf of the United States government or any foreign government pursuant to treaty or agreement.

Also as to these inventions, the government will have the right to grant licenses to others for the practice of such inventions throughout the world for any purpose whatsoever upon such terms and conditions as the administrator may prescribe. The government's right to grant licenses is unrestricted as to both the parties to be licensed and the purposes for which such inventions may be practiced.

So far I have referred to inventions that might be strictly determined to be made under or in anticipation of the cooperative agreement. In addition, however, NASA and AT&T have agreed that certain rights are to be acquired by the government with respect to any inventions made as the result of AT&T sponsored research during the period beginning on May 18 of this year and running through to one year after the last launch.

"AT&T sponsored research" includes any project which "has as one of its purposes advancement of the state of the art in communication satellite systems, equipment, components, or ground tracking, transmitting, or receiving facilities therefor." Now, as to any such invention made during this period by AT&T, the government will obtain a royalty-free license to practice the invention throughout the world by or on behalf of the United States government.

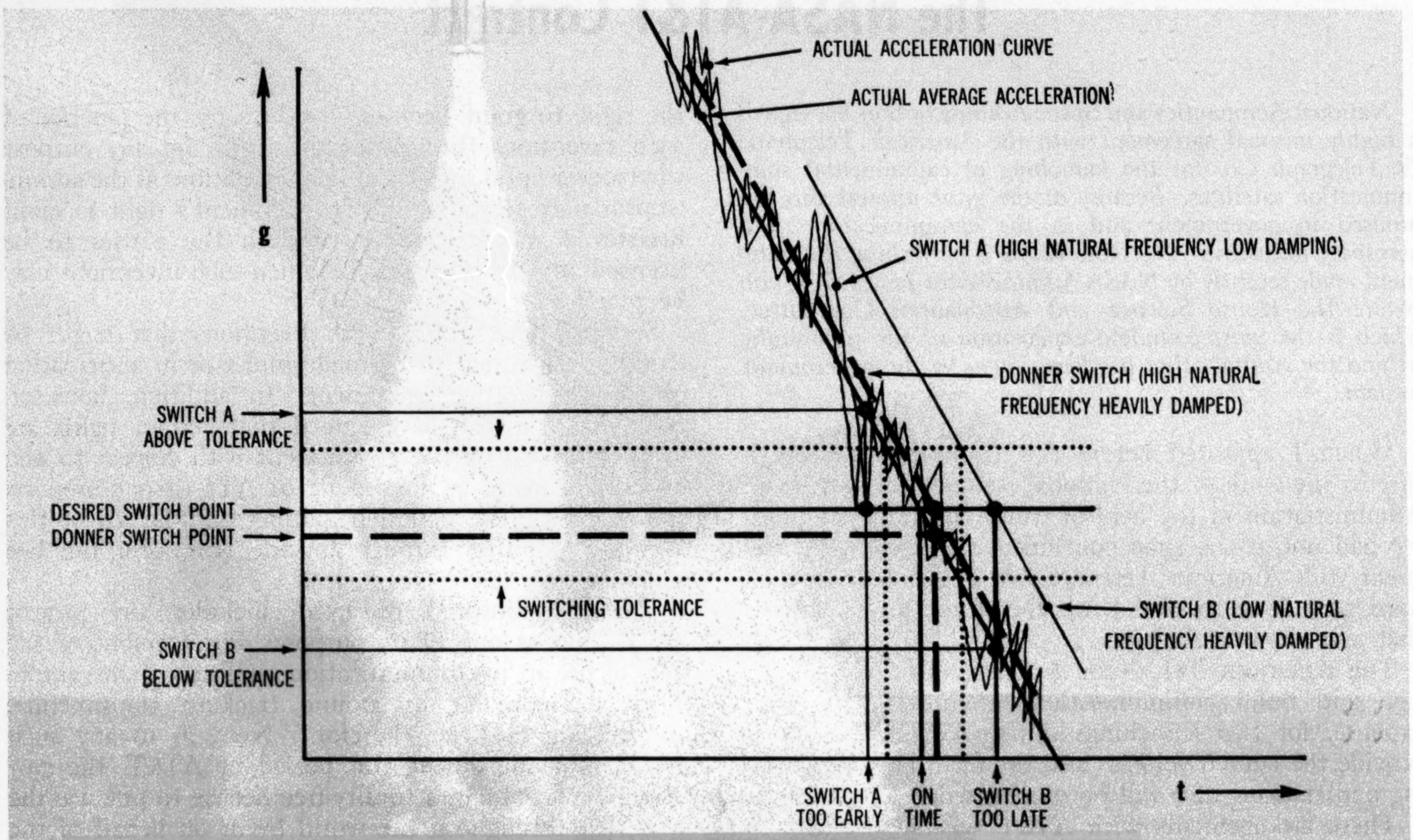
In addition, we have specifically agreed that the administrator shall have the right, in connection with the operation of a communication satellite system or the production of components for a system, to "grant licenses to business entities domiciled in the United States, under such terms and conditions as the administrator may prescribe for the practice of such inventions throughout the world."

The significance of the patent provisions agreed to by NASA and AT&T is that whatever form of organization may be determined to be in the public interest and approved by the Federal Communications Commission for providing communication services to the public through satellite relays, that organization will be able to use inventions made by AT&T while in this cooperative relationship with NASA.

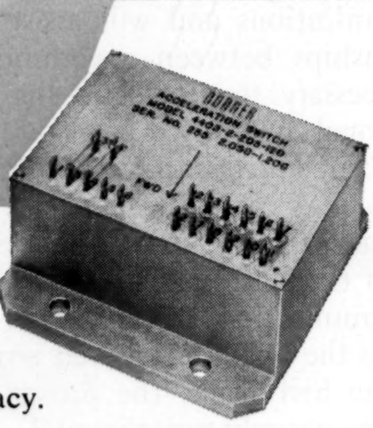
As you are aware, the President has stated, and the Federal Communications Commission has announced that one of the principles which should govern the operation of a communication satellite system is that there be competition in the production of equipment for the satellite system. Our purpose in negotiating the patent arrangements, which I have described, with AT&T is to be able to assure the free availability of any resulting inventions in the public interest.

The AT&T agreement, in my judgment, is a forward step in the development of cooperative relationships between government and industry to attain an important objective in the practical application of space technology.

There's only one reason to specify Donner acceleration switches



..BECAUSE THEY UNDERSTAND THE MEANING OF ACCURACY



It's dynamic accuracy that counts. In truth, several firms make precision acceleration switches. But accuracy, like reliability, is a term with shades of definition. Some switches are accurate in the lab or on the test bench. That is, they provide *static* accuracy. Donner acceleration switches give you accuracy where it counts, on the operational missile. They are *dynamically* accurate.

Look at the graph above. Under static conditions, switch "A" with a better switching response, might be desirable. But suppose the missile were experiencing a 10 g vibration of a high frequency nature and proper thrust cutoff depended on detecting a 2 g switch point. Switch "B" would eliminate the problems of early switching, but introduce intolerable phase shift which in turn would make the switch "see" the event after it actually occurred. In other words, under the dynamic conditions of missile and aircraft flight, it is absolutely necessary to know when an event occurred rather than precisely where it occurred. Frequency response becomes a more important consideration than switch accuracy.

Heavily damped, with a high natural frequency, Donner acceleration switches have low phase shift providing the transient response necessary to follow rocket engine operation and perform their task with meaningful accuracy.

Donner Acceleration Switches are Flexible

Because of the inherent flexibility of Donner's basic accelerometer servo system and associated electronics, Donner acceleration switches will satisfy virtually any requirement.

Features include multiple switch points, any specified damping ratio, built-in time delays to overcome initial transients or delayed output, memory damping, and total programming capacity.

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In the Front Office

Thomas V. Jones, a director of Stanford Research Institute, Menlo Park, Calif. Mr. Jones is president and chief executive officer of Northrop Corp.

Mansfield D. Sprague, president and chief executive officer, AMF Overseas Corp., Geneva, Switzerland, subsidiary of American Machine & Foundry Co., and **Frederic Chapuisat**, general manager.

Lester C. Van Atta, special assistant for arms control, Office of the Secretary of Defense, will return to Hughes Aircraft Co. as director of the company's Malibu Research Laboratories replacing **Andrew Haeff**, who is leaving the company.

Kenneth M. Smith, a vice president, General Dynamics Corp., San Diego, Calif. Also: **Lawrence E. Spear**, vice president-plans and programs, General Dynamics/Pomona.

General Dynamics/Astronautics, San Diego, Calif., has announced the following appointments: **William H. Patterson**, vice president-advanced product planning; **Charles S. Ames**, Saturn S-I program director; **George M. Robertson**, director of management systems; **William L. Van Horn**, Atlas program director; **Dr. Andrew Kalitinsky**, Apollo program director.

Dan W. Burns, vice president in charge of defense activities, The Siegler Corp., Los Angeles, Calif. Also: **Walter J. Kruel**, president, Hufford Division of The Siegler Corp., El Segundo, Calif.

Fredric M. Cooper, vice president and general manager, Amcel Propulsion, Inc., New York, N. Y., succeeding **Julius P. Zeigler**, resigned.

L. A. Carter, assistant for management evaluation to the vice president and Space Systems Division general manager of Lockheed Missiles and Space Co., Sunnyvale.

Richard A. Fitzgerald, vice president, Seaboard World Airlines, with offices in Washington, D. C.

W. W. Smith, vice president-engineering, Babcock Electronics Corp., Costa Mesa, Calif.

William F. Gates, vice president-products, Dalmo Victor Co., Belmont, Calif., a division of Textron, Inc.

Richard K. Mosher, vice president in charge of the Systems Division, LFE Electronics, Laboratory for Electronics, Inc., Boston, Mass.

Albert G. Wald, divisional controller, Sperry Utah Co., division of Sperry Rand Corp., Salt Lake City, Utah.

Dr. F. Joachim Weyl, deputy chief and chief scientist, Office of Naval Research, Washington, D. C., replacing Dr. Thomas J. Killian, resigned.

Capt. Sam E. Edelstein, Jr., USN, director of the Armed Services Electro-Standards Agency, Fort Monmouth, N. J.

Paul A. Hower, chief of operations analysis, Strategic Air Command, Offutt AFB, Neb., succeeding **Dr. Rodney H. Smith**, resigned.

Stanley W. Henceroth, executive officer of the Federal Aviation Agency's Flight Standards Service, Washington, D. C.

(Continued on page 112)

INDUSTRY OBSERVER

► New type of radar for detecting and tracking space vehicles, which may provide resolution and position measuring accuracy 100 times better than current radars, is being investigated by Rome Air Development Center. Technique, conceived by RADC engineers, is called Active Swept Frequency Interferometer Radar (ASFIR). RADC hopes to demonstrate the technique with an experimental system in Fiscal 1963 and expects to begin procuring hardware in this fiscal year.

► Air Defense Command tactics, formerly standardized around lead-collision interception, have been modified to include the pursuit mode originally designed into the Convair F-106 and its MA-1 fire control system. Change in tactics reflects concern over increased performance of Russian bombers and the need to be able to chase as well as intercept a supersonic target.

► Six chimpanzees are in final training at Holloman AFB, N. M., for Mercury orbital flights but there is growing agitation to eliminate the three-orbit chimp flight that is now scheduled to precede a manned orbital flight. Decision to eliminate the chimp flight could be made immediately after the Mercury-Atlas 4 flight, which is to place an unmanned Mercury capsule into orbit for a single pass around the earth.

► Ultra low pressure rocket designs are being studied as possible competitors for electrical propulsion systems in space. Designs now being tested at USAF's rocket test facility at Edwards AFB, Calif., use conventional pressure-fed bi-propellant system and radiation-cooled nozzles. Pressure ratio across nozzle approaches infinity as downstream pressure approaches the vacuum conditions of space.

► USAF plans to use a Scout-launched satellite to test the rendezvous and clocking systems for the Saint satellite intercept payload, which will be launched by an Atlas-Agena vehicle.

► Interim interceptor modification program is being carried out on McDonnell F-101 and Convair F-102 and F-106 aircraft to give all three infrared capability for target acquisition, lock-on and completion of run. Four other modifications are being made to the F-101 and F-106 to improve their fire control performance and other operations in an electric counter-measures environment.

► Air Force has officially dropped the name Bambi for its program to investigate possible techniques for intercepting ballistic missiles during their boost phase. Move is intended to emphasize that the program is a techniques study rather than a weapon system effort.

► Lockheed QF-104 drones will be phased in to replace the few Vought Regulus II drones used in the Bomarc program. Modified Regulus II missiles, one of three drone targets for the supersonic Bomarc, have averaged seven or eight flights each before being destroyed.

► New requirements for instrumentation at the Atlantic Missile Range specified the ability to measure burnout velocity within 2-3 fps. and to determine the circular error probability within 0.1 naut. mi. at a distance of 8,500 naut. mi.

► USAF is considering placing permanent deep space observation stations at the neutral points 60 deg. ahead of the moon and 60 deg. behind it in its orbit where, because of the combined gravity forces of the earth, moon and sun, only very small amounts of energy would be required to keep the vehicles on station.

► New version of the Beech KDB-1 Cardinal target drone, with the 120-hp. McCulloch piston engine uprated to 150 hp. and wings sharply clipped, is undergoing flight tests at the McGregor range, Ft. Bliss, Tex. Improvements raise the normal 305-kt. cruise speed by 25 kt. Earlier version is averaging six flights per drone against initial prediction of two flights. Some drones have lasted for 15 flights and one has survived 26 missions.

RAIN

HAIL

THUNDER

LIGHTNING

ICE PELLETS, SLEET

HIGH DRIFTING SNOW

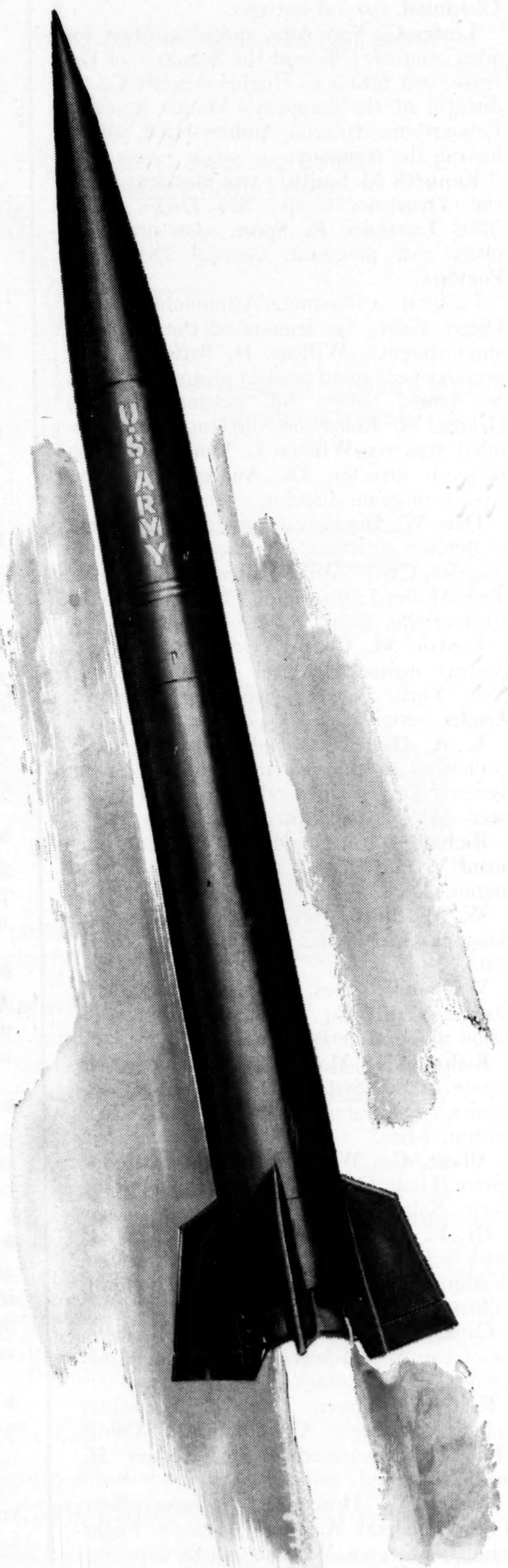
weather bird

Rain (··) hail (Λ) thunder (ꓘ) lightning (<) ice pellets, sleet (✱) high drifting snow (⫲) are merely symbols on a weather map—not expected to be problems to the U. S. Army's SERGEANT missile system.

SERGEANT missile system's objectives are to be ready for action in the meanest weather, the most extreme temperatures and environments, at high and low altitudes. It can be checked out by one man with minimum training, emplaced and fired in a very short time by a six-man crew.

The land, sea and air-transportable SERGEANT system, produced for the Army by Sperry Utah—when it becomes operational—will take its place among the tough and dependable sergeants of U. S. Army tradition.

SPERRY



SPERRY UTAH COMPANY, *DIVISION OF SPERRY RAND CORPORATION • SALT LAKE CITY, UTAH*

Washington Roundup

Research Warning

Defense Department's Office of Research and Engineering, which was warned recently in congressional hearings to give defense research the same kind of flexibility and quick response time that the President is trying to give the military services, has added another assistant directorship. Arthur W. Robinson, Jr., who has been manager of space business for General Electric Co., will handle international programs.

Sen. Jacob Javits told Dr. Harold Brown, director of the office, that the military research program needs "dynamic sensibility," and said it must not be like "a prehistoric monster that cannot move around because it is so big, so unwieldy. You have got to move fast." Brown, who agrees, said the package program approach to budgeting will help. Sen. Hubert Humphrey, who sees a need for far more government unification on research projects, heads a special subcommittee that is doing considerable staff work to determine ways to improve long-range planning and spending.

Congressional demands for an acceleration of the nuclear rocket program are expected to result from hearings scheduled by Rep. Melvin Price's Joint Atomic Energy Research Subcommittee for Aug. 28 and 29. No legislation is expected to result but Rep. Price will try to push Project Rover and update the record on Snap auxiliary power units and the Pluto nuclear ramjet.

Contracting Criticism

Selection of International Telephone & Telegraph Co.'s Federal Division to supply a new $10-million trans-Mediterranean tropospheric scatter communication system as part of the Air Force's 480-L AirCom system has evoked outspoken criticism from unsuccessful bidders. Another ITT subsidiary, International Communication Systems Corp., is prime contractor on the 480-L program and prepared original specifications for the trans-Mediterranean system procurement.

A similar problem may arise in upcoming contracting for USAF's Headquarters Control System (473-L). International Business Machines, which is writing performance specifications for 473-L, is expected to bid for a major portion of subsequent hardware procurement.

Airlines' concern over hijacking has begun to decline as a result of Cuba's return of an Eastern Electra and a Pan American DC-8. With new legislation expected to discourage the piracies and no evidence that the Castro government is actively behind them, most carriers feel that suggested protective measures such as armed guards and locked doors could pose a far greater threat to passengers and aircraft than the risk is worth. In addition, most airlines find their insurance covers such thefts. They are concluding that passenger safety should be secured at all costs—including that of a stolen aircraft.

Patent Policing

National Aeronautics and Space Council has told Executive Secretary Edward C. Welsh to police all patent arrangements in space communications. The council already is attempting to develop a government policy for such inventions and it brought Justice Department into the National Aeronautics and Space Administration-American Telephone & Telegraph satellite negotiations. The council was largely responsible for the "no rights" patent policy precedent established in the AT&T contract.

Vivarium capacity of Air Force's Aerospace Medical Field Laboratory at Holloman AFB, N. M., will be expanded from 52 to 100 chimpanzees under a $490,000 award from National Aeronautics and Space Administration. NASA originally wanted its own vivarium but congressional objections and the initial cost of constructing and outfitting a new facility made duplication of the Holloman facility seem impractical.

Halaby Speculation

Report that Francis Fox, director of the aviation department for the city of Los Angeles, will join the Federal Aviation Agency has started speculation that Najeeb Halaby may be leaving the administrator's post. Fox is expected to move into FAA as deputy administrator but probably would be the President's choice for the top job if Halaby left.

Britain's Royal Air Force is not starting a space program as the British press reported recently. RAF Group Capt. A. H. Hewitt, deputy director, department of assistant chief of air staff (operations requirements), will correlate and report to his chief on all aspects of space pertaining to United Kingdom defense, and to the RAF in particular.

Capt Hewitt got this assignment in addition to his other duties because he previously was the unidentified flying objects man. London's press, intrigued by the similarity between the initials for Director Operations Requirements-Space (DORS) and the last name of buxom British actress Diana Dors, gave the story more ample treatment than the RAF felt it deserved.

—Washington Staff

Panel to Probe Bioastronautics Effort

White House group will review civilian, military work to assure broad support for space program.

By George Alexander

Washington—Bioastronautics, a major branch of space technology in which many experts feel the U. S. is moving at half-speed without specific direction, is to be studied by a presidential panel to assure that requirements of future manned space programs will be satisfied by a growing national life sciences capability.

These experts hope the panel, to be headed by Dr. James B. Hartgering, technical assistant to Dr. Jerome Wiesner, President Kennedy's special assistant for science and technology, also will put an end to the fighting over bioastronautics between the military services and the National Aeronautics and Space Administration by making recommendations that will clearly define the life sciences roles of each agency.

Earlier this year, Rep. Emilio Daddario (R.-Conn.), a member of the House Science and Astronautics Committee, issued a 43-page report (AW Mar. 6, p. 27) urging the President to direct the National Aeronautics and Space Council to make a prompt study of all life sciences work in support of space programs. His report also urged that a central bioastronautics authority be created to formulate a comprehensive national plan and that NASA be "enjoined from further expansion of its life sciences research efforts" until such a program was established.

Origin of Panel

The Hartgering panel resulted from a request from Dr. Edward Welsh, executive secretary for the space council, to Dr. Wiesner for a review of bioastronautics, and one high government official who is familiar with the panel said its purpose is "to make sure that this [bioastronautics] capability expands into a truly national program." For these reasons, life sciences personnel—especially among the military—are hopeful that the other Daddario recommendations will appear in the panel's final report.

President Kennedy is reported to have become concerned with the margin of medical safety involved in manned space flight shortly before Cdr. Alan B. Shepard's suborbital Mercury-Redstone flight last May 5. At the President's request, Dr. Wiesner quickly formed a panel, composed mostly of physicians said to have been unfamiliar with space or aviation medicine.

When this panel reviewed data on the pulse and respiratory rates of X-15 and Mercury pilots recorded during flights or Mercury training tests, they became alarmed at what they considered to be abnormally high readings. They suggested that Shepard's flight be postponed until a sphygmomanometer could be built into the pilot's bioinstrumentation system to measure blood pressure.

Mercury program officials, backed by military bioastronautics personnel, convinced the panel that the data was not abnormal for well-trained men under the stresses of high-performance flights or tests and that the instrument, although desirable, was not absolutely necessary for the flight.

This experience undoubtedly contributed to Dr. Hartgering's careful selection of panel members with some background or familiarity with bioastronautics. As of last week, only two men—both of them physicians—had been chosen. The panel, when fully staffed, is expected to number about 10 or 12 specialists, with both the medical and engineering professions represented. First meeting of the panel is tentatively scheduled for September and the panel is expected to focus its immediate attention on the Apollo program.

Possible Solutions

Industry and government observers see several possible solutions to the military-NASA life sciences problem:

- **Two separate bioastronautics** capabilities, one civilian and the other military, with coordination at a Defense Department-NASA headquarters level.
- **Assignment of some military** bioastronautics facilities and their personnel to NASA on a full-time basis.
- **Consolidation of all military** bioastronautics units, facilities and personnel into one joint military organization, designed primarily to satisfy the space requirements of the armed forces, but expanded to handle all civilian space needs. A high-ranking military officer would be assigned to NASA in a liaison capacity to integrate its requirements into the military program.

The first proposal, these observers say, would be prohibitively expensive

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Grand Jury Checks Semiconductor Pricing

Los Angeles—Pricing practices of semiconductor companies will come under the scrutiny of a federal grand jury later this month, adding to the problems of an industry faced with mounting competition, plummeting prices, and shrinking profits.

Speculation within the industry is that the federal jury may be seeking evidence of price fixing before the present onslaught of price cutting, collusion in price cutting or possibly illegal competitive practices.

Complete pricing records of at least seven companies have been subpoenaed to be presented to a federal grand jury convening in Dayton, Ohio, later this month. Indications are that other companies will be required to produce similar information.

The seven firms have been asked to produce pricing records going back to 1957. Names of all corporation individuals who had anything to do with pricing of semiconductor components as well as all correspondence relating to pricing during the indicated period are among the subpoenaed information. Each company will also be required to supply details of incorporation, names of corporate officers, etc.

Companies called in the inquiry include Sylvania Electric Products, Inc., Woburn, Mass.; Transitron Electronic Corp., Wakefield, Mass.; the Semiconductor Division of Hughes Aircraft Co., Newport Beach, Calif.; Raytheon Co., Waltham, Mass. and Pacific Semiconductors, Inc., Culver City, Calif. Others reportedly include a company in the metropolitan New York area and another in the Midwest.

The grand jury action comes as a surprise to industry sources despite earlier Justice Department inquiries among component firms. Justice had requested data about percentage of sales to the military, percentage of sales in general semiconductor device categories, etc., information of a similar nature to that supplied on a quarterly basis by the industry to the Department of Commerce's Electronic Production Resources Agency.

These sources point out that prices of semiconductor devices are continuing to drop sharply and therefore do not suggest any possible conspiracy to fix prices. In fact, an increasingly common feeling in the industry is that some device lines are, knowingly or not, being sold below cost (AW June 12, p. 73).

First C-141 Subcontract

First of 20-25 major subcontracts for the Lockheed C-141 transport approved by USAF in a program being closely monitored by Congress and the White House was awarded last week to Rohr Aircraft Corp. for pylons and turbofan engine pods. Rohr was low bidder in the competition.

Initial contract covers five airplanes, but follow-ons are expected. Rohr will manufacture pods and components at its Chula Vista, Calif., plant and assemble them at its Winder, Ga., plant, where Rohr has been building C-130 nacelles. Winder is about 35 mi. from Lockheed's Marietta, Ga., plant where the C-141 or the Lockheed 300 commercial version will be assembled.

Awarding of subsequent contracts is expected to be a slow process as they move up Air Force channels, including congressional and Executive liaison offices, although pressure to aid distressed areas has slackened with the advent of the Berlin crisis.

and would probably lead to areas of duplication and controversy. The second, if it could be accomplished over the inevitable protests of the military, would virtually eliminate the three services from the bioastronautics field—a result which neither the services nor certain congressional quarters would be likely to accept.

Military personnel find the third proposal the most appealing, but NASA—feeling that the services are too mission or hardware-oriented and centered on a man in a cockpit—doubts if this arrangement would satisfy its requirements for research on other bioscience interests such as extraterrestrial life forms, as well as its own particular needs for manned systems.

Attention, therefore focuses on the Hartgering panel and the report it will forward to the President. Most observers believe it will take a presidential decision to straighten out the present controversy in bioastronautics.

The Air Force, which has been the most outspoken of the three services, has begun consolidating all its own aviation-space medicine and bioastronautics units under a new directorate to be formed in the Air Force Systems Command.

A memorandum is now being circulated among all operating USAF commands, seeking their comments on the proposed consolidation, but Aviation Week has learned that the basic decision has already been made with unanimous concurrence. The Brooks Aerospace Medical Center at Brooks AFB, San Antonio, Tex., will be transferred from Air Training Command to Systems Command in the near future.

USAF and Navy Unable to Agree On Joint Tactical Fighter Project

By Larry Booda

Washington — Possibility that Air Force and Navy could agree on a single configuration for an air superiority tactical fighter (TFX) disappeared last week.

A proposed memorandum for the signatures of the two service secretaries, reporting to Secretary of Defense Robert S. McNamara that they could not reach a compromise, was circulated through Air Force and Navy staff offices.

Thus what was first proposed as a single tri-service tactical fighter in President Kennedy's budget message last Mar. 28 now is quite likely to be three aircraft instead (AW Apr. 17, p. 29). An earlier decision had already split off the low-altitude, close support, short-takeoff and short-landing mode aircraft (VAX).

Air Force wants an aircraft that can fly high-altitude air superiority missions at Mach 2.5, with increases in performances eventually to Mach 3. This would place the aircraft in the class of the canceled F-108. In addition it wants a capability to deliver a nuclear weapon by approaching a target at low altitude.

Air Force also wants the TFX to have the ability to dash in and out at supersonic speeds. Combined with a long ferry capability this would produce an aircraft of 80,000 to 90,000 lb. at takeoff. Fuselage length would be 85 or 90 ft.

Navy proposal did not include the long, low-altitude in-and-out dash. This permits a smaller configuration that can conform to Navy aircraft carrier elevator and hangar deck dimensions. Navy ideas envisioned an aircraft considerably smaller than the current carrier based large attack class, which includes the North American A3J and the Douglas A3D. High-altitude performance parameters are similar to Air Force proposals.

Navy also expects to take some minor weight penalties in cutting over-all fuselage length and vertical stabilizer heights by incorporating folding features. This kind of penalty has been standard in Navy aircraft since the advent of the carrier and is not considered a serious factor.

Air Force reminded the Navy that Navy has designed 80,000-lb. aircraft that can operate from carriers. Navy countered that development of air superiority aircraft as big and as costly as supersonic bombers is not logical, and said the job could be done with a smaller aircraft.

As of last week, the positions of the two services in weight were: Navy, 55,000 lb., compromised from an original 50,000 lb.; Air Force, minimum of 65,000 lb. In length, Navy wants 56 ft. to avoid the folding feature but is willing to accept more length and incorporate the folding.

TFX is Air Force nomenclature for Tactical Fighter, Experimental. VAX is Navy terminology for Heavier-than-air, Attack, Experimental. Navy has cognizance of the VAX program.

Although there is no indication what decision Secretary McNamara will make when presented with the impasse, enough has been said by President Kennedy and McNamara on the subject of delivery of conventional weapons rather than nuclear weapons that another aircraft designed to deliver nuclear weapons may not be well received.

It is possible that the office of Defense Research and Engineering will again be given the task of evaluating the merits of the service proposals and recommending a decision to McNamara. This was done when the VAX project was split off to fulfill the ground support mission, leaving interdiction, reconnaissance and air superiority as the TFX missions.

Agreement on the VAX between the Army and the Navy is near. Requests for proposals will be sent to industry about three weeks after agreement.

In another related project, the tri-service VTOL transport, the proposals have been so varied that no definitive configuration has yet been chosen (AW Feb. 27, p. 33).

LTV Anti-Trust Suit

Anti-trust suit was filed by U. S. government against Ling-Temco Electronics, Inc., and Chance Vought Corp., Dallas, Tex., Aug. 16, asking dissolution of the merger of the two firms and asking for a temporary restraining order in Dallas District Court to hold up the merger. Less than five hours prior to the filing, the boards of both companies had taken final action on the merger and the board of the newly merged company then held a meeting some three hours prior to the Department of Justice action. Government claims that the merger violates six provisions of the Clayton Anti-Trust Act—basically lessening competition between the two major government contractors and tending to create a monopoly in an industry which primarily subsists on defense contracts. Dallas District Court judge denied the federal motion for a temporary restraining order and ordered a hearing on a preliminary injunction for Sept. 11.

Hughes Joins Space Communications Race

By Katherine Johnsen

Washington—National Aeronautics and Space Administration is negotiating a $4-million contract with Hughes Aircraft Corp. for a 22,300-mi. altitude communications satellite and has announced that its doors are wide open for negotiations on any other space communications proposal that "advances the state of the art."

The offer was made by NASA Administrator James E. Webb in an appearance before the Senate Small Business Monopoly Subcommittee, headed by Sen. Russell Long (D.-La.).

Sen. Jacob Javits (D.-N. Y.) noted that NASA, after awarding Project Relay to Radio Corp. of America from a field of seven competitors, opened negotiations with American Telephone and Telegraph Co. for a similar low-orbit random type satellite (AW Aug. 7, p. 26), and suggested that "the same opportunity be available to the other five" unsuccessful Relay bidders.

Webb declared that "we will press forward in any area that we can learn something that is needed to move on to an operational system."

NASA's announcement of the Hughes negotiations followed congressional and industry criticism that a low-orbit random system would be made obsolete by a satellite in a stationary 22,300-mi. altitude orbit such as Army's Advent will have, long before it is established on a global basis (AW Aug. 14, p. 33). The Hughes satellite, called Project Syncom—will have a non-stationary synchronous orbit that will trace an elongated "figure eight" pattern 33 deg. north and south of the equator at a longitude near the East Coast of the United States.

Syncom Configuration

The Syncom satellites will be quite similar in weight and external configuration to the 52-lb. prototype built by Hughes at NASA's encouragement last year and described by AVIATION WEEK (Oct. 17, p. 26 and Dec. 12, p. 52). The electronic payload, however, will be altered in some respects to support the Advent project.

Selection of Hughes without an industry competition ended more than a year's discussion between NASA and the company. Discussions were disrupted late last fall when other companies made known their interest in active communications satellites and NASA decided to hold industry-wide Relay competition.

The first Syncom launch, by a three-stage Delta vehicle, is planned for late 1962. It will be injected into orbit by an additional solid propellant rocket attached to the spacecraft.

Project Relay and the AT&T satellite are scheduled for first launches early in 1962. Relay will move in an elliptical orbit from 900 to 3,000 mi. altitude, and the AT&T satellite in an elliptical orbit from 600 to 3,000 mi.

The Hughes contract calls for at least three flight units. NASA said test results will be made available to commercial and governmental communications interests worldwide—the "no rights" patent policy that also is included in the AT&T contract.

Syncom will be managed by NASA's Goddard Space Flight Center and the facilities of Army's Advent Management Agency at Ft. Monmouth, N. J., will be utilized.

In subsequent testimony to the Long subcommittee, Roy H. Isaacs, vice president of Bendix Corp., one of the unsuccessful Relay bidders, said his firm "would be interested" in Webb's proposal to open negotiations.

In line with NASA's actions, spokesmen for the National Aeronautics and Space Council and the Federal Communications Commission stressed in their subcommittee testimony that the bywords of the Administration's communications satellite program at this point are speed, urgency, and no commitments—notably as to ownership, frequencies, or patents.

International Negotiations

Both Newton N. Minow, chairman of FCC, and Dr. E. C. Welsh, executive secretary of the space council, viewed 1962 as a year of experimentation and wait-and-see before "we can know what type of a system we want." A comprehensive global system is ruled out before international negotiations on frequencies are held at the conference of the International Telecommunication Union late in 1963.

Welsh said that the "probable" approach appears now to be that the U. S. will first launch a system of 30 to 60 satellites in random orbits at 3,000- to 8,000-mi. altitude. Higher orbits require fewer satellites for the same coverage.

Welsh doubted that the initial system would be composed of Advent-type satellites "unless there is a speed-up or breakthrough." He said that experimentation on fitting two, three, or more satellites on each launch vehicle promises to sharply cut the present estimated launch cost of $6 million per satellite. Welsh said that $100 million is a "plausible" estimate of the cost of establishing the type of system he projected.

Brig. Gen. William M. Thames, commander of the Advent Management Agency, presented a more optimistic view on an Advent type of system in testimony to the House Science and Astronautics Committee. He assured the committee that an "operable" system of one Advent would be achieved in late 1963 or early 1964. If Army were assigned a mission for a system of three, which would give global coverage, it could be put in operation "prior to 1965," Gen. Thames said.

The first Advent, scheduled for launch early in 1962, will be put in orbit at a 600-mi. altitude and orbit the earth every 6 hr. This will be operationally similar to the final versions which will be in a synchronous orbit at a 22,300-mi. altitude, Gen. Thames said. He said "the satellite structures and microwave relay equipment to be carried are now in the process of fabrication . . . and the boosters are in the production line."

AT&T Attacked

Meanwhile, Sen. Long continued his attack on the "monopoly" position of AT&T in the present voice communications field, in his campaign to preclude the company from dominating a space communications system. He charged that AT&T is "trying to fit space communications into its existing monopoly pattern."

Two points Sen. Long developed at hearings with Minow and other FCC representatives were:

- **FCC has little control** over AT&T telephone rates. There never has been a formal rate case on the rates charged by AT&T because the task would be "so gigantic," according to Minow. He said he was unable to give any estimate as to how much manpower or how many years such a proceeding would require. Over the years, rates have been negotiated downward in joint agreements between the corporation and FCC.
- **AT&T purchases 100%** of its equipment from Western Electric Co., its wholly owned subsidiary, and any overcharges by Western Electric could be passed on to telephone users and could place Western Electric at an advantage with its competitors in the equipment field. FCC said that as a result of a letter it wrote in July, Western Electric volunteered early in August to reduce its charges to AT&T for 1960 by $26 million. FCC's letter to Western Electric read: "While we have never expressed an opinion as to what constitutes a proper level of earnings for your company on Bell business, we have no hesitancy in concluding at this time

that your return for the year 1960 appears excessive. . . ." Minow assented to Sen. Long's statement that FCC has no way of ascertaining whether the $26 million reduction was adequate.

FCC Commissioner T. A. M. Craven denied allegations by Sen. Long that FCC pressured the Justice Department into changing its original position—that aerospace companies must be permitted to participate in ownership of a space communications system. Justice's present position—and that of the President—is that any privately own system must have a broad participation and must not be dominated or controlled by any one company (AW July 31, p. 25). A committee representing the 10 international common carriers and appointed by FCC is to make recommendations on ownership of a space communications system by Oct. 13.

James T. Pyle, deputy administrator of the Federal Aviation Agency, told the Long subcommittee that FAA is looking to satellites for solution of the "major communications problems" confronting civil aviation. He said satellite techniques appear to have the potential to meet air traffic control and navigation needs in five areas:

- **Point-to-point communication,** particularly for international circuits.
- **Ground-air-ground communication,** particularly over inaccessible areas where the location of short-range communication stations is physically impracticable.
- **Long-range navigation.**
- **Meteorological service,** including the automatic distribution of weather information to all stations.
- **Communication and navigation** associated with supersonic transport and high performance military aircraft.

Senate Unit Approves Rocket Facility Funds

Washington—Senate appropriations committee last week approved $12 million to start construction of facilities for development of large solid-propellant boosters. The funds, originally requested by Air Force (AW June 26, p. 26), were allocated to Secretary of Defense.

In acting on the Fiscal 1962 military construction appropriation bill, House appropriations committee declined to consider the new solid-propellant facilities because planning and the ultimate cost were vague.

In a statement to the Senate appropriations committee, Defense Department said the $12 million "represents the first increment of the program, estimated to cost, over several years, between $60 and $100 million."

Senate appropriations also approved $17.5 million for an aerospace systems environmental test chamber at Arnold Engineering Development Center.

Detection Research to Be Pushed By New U.S. Disarmament Agency

By George C. Wilson

Washington—Expanded research program to perfect techniques for detecting nuclear explosions appears certain to emerge from the government's latest efforts to improve its organization for handling disarmament.

Focus at the moment is on President Kennedy's bill to establish a separate and permanent disarmament agency that would, as one of its functions, coordinate nuclear detection work within the government and contract with private industry for additional research. The bill underwent hearings last week before the Senate Foreign Relations Committee. The measure received bipartisan support, including that of former President Eisenhower and his Secretary of State, Christian Herter. Sen. Hubert H. Humphrey (D.-Minn.), chief sponsor of the bill and a member of the committee, predicted Congress would pass the bill before adjournment.

Even if the measure is pushed aside during the pre-adjournment rush of legislation, the Kennedy Administration is expected to expand its nuclear detection research. President Kennedy favors it, and Sen. Humphrey plans to continue pressing for more emphasis on the technological side of disarmament. Sen. Humphrey told Aviation Week that the research effort now underway in this field "is totally inadequate."

The Minnesotan, who sat in on several disarmament sessions with the Russians, recently told Director of Defense Research and Engineering Harold Brown during a hearing on Pentagon budget policies that "we have not pooled our resources in inspection and detection as we ought to with sufficient magnitude. I think the government has been derelict and I think those who are primarily responsible for weapons have the upper hand rather than those who are primarily responsible for the detection of weapons . . . I think they [detection people] got the lower hand, and very low. . . . If we were as negligent in rocket development as we have been in detection and inspection, we would be still flying kites."

As part of his campaign to expand nuclear detection research, Sen. Humphrey has armed himself with figures comparing money spent on weapons development with that spent on detection research. He intends to make public an unclassified version of this comparison. Sen. Humphrey is especially unhappy about the lack of Administration support for a National Bureau of Standards project to develop an electromagnetic detection technique.

Dr. Herbert F. York, director of defense research and engineering during President Eisenhower's administration, agreed that detection research should be expanded. He told Aviation Week that " we have just scratched the surface" in this field, and said detection research is more difficult than that connected with weapons development because "we don't even know what the problems are." Dr. York said that although there is no way to "make it impossible" for nuclear blasts to go undetected, technical aids developed through an expanded research program can make it "more and more difficult" to test nuclear weapons secretly.

Dr. York endorsed the bill to establish the full-time disarmament agency, declaring that "it is already too late." The only alternative to breaking the disarmament deadlock and ending the arms race, he said, is "complete and utter disaster and catastrophe."

Backers of the bill hope the new disarmament agency would equip U. S. negotiators with technically-sound proposals for providing some type of inspection system agreeable to the Russians. The disarmament agency also would, it is hoped, find the technological shortcomings of Russian proposals. As Secretary of State Dean Rusk said in urging congressional approval of the bill: "We should be in a position to play for the breaks."

John J. McCloy, President Kennedy's disarmament adviser, said in endorsing the bill that "this subject [of disarmament] is too serious not to have continuity of effort, not to have the means of employing the best minds that we can possibly bring to bear on the subject."

The proposed U. S. Disarmament Agency for World Peace and Security would have an annual budget of about $6 million and employ about 250 people. The bill states that the agency "must have the capacity to provide the essential scientific, economic, political, military, psychological and technological information upon which realistic disarmament policy must be based." The House has not yet acted on the disarmament bill.

The disarmament measure, almost certain to be passed next year if not this, would embark many firms on a new direction of research. If disarmament negotiations should succeed, this type of research would help take up the slack caused by a decrease in U. S. contracts for weapons development.

F-1 Engine Indicator Malfunctions In First Public Static Firing Test

Edwards, Calif.—First public static firing of the NASA-Rocketdyne F-1 space booster engine was terminated automatically after 1.5 sec. of operation rather than the programed 20 sec. when an indicator switch signaled that a special propellant valve was not open.

The valve is one of an extra pair of valves installed on the first two engines as a safety measure for tests. The third engine and all subsequent ones will not have them. The error signal which initiated the automatic shut-down was incorrect. The valve was open but the switch housing had separated from the switch itself and its movement was interpreted wrongly by the automatic control equipment.

An uncooled and detachable segmented nozzle extension is used in the F-1 engine so that the expansion area ratio can be modified to suit the mission by installing the appropriate skirt, NASA revealed. The length of the expansion cone can be tailored to provide area ratios from 10-1 to 16-1. The length of the cooled permanent part of the expansion section plus the combustion chamber is 11 ft. The nozzle throat is 40 in. dia. and the exit diameter of the cooled part of the expansion section is 9.5 ft.

NASA and Rocketdyne officials said the F-1 has been designed to a reliability specification higher than that of the proven Redstone engine which produces little more than 5% of the thrust. In general, the design features of the big engine have been copied and scaled up from the smaller Rocketdyne engines used in the Atlas ICBM and the Thor IRBM. Rapid progress in the F-1 program is cited as one important reason for the decision to develop the C-3 version of the NASA Saturn and skip the C-2 version. The C-3 is to be powered by a pair of F-1 engines which will nearly double the thrust of the cluster of eight H-1 engines which will be used to launch the Saturn C-1.

Rocketdyne said that 10 firings of the complete F-1 system, and more than 140 thrust chamber runs at thrust levels of 1 million lb. or more have been conducted at the NASA Leuhman Ridge High Thrust Test Area, Edwards, Calif. since the first brief main stage test in March, 1959. The F-1 has now been operated at a high thrust level for an aggregate total of 7 min. 30 sec. Component tests have been run at the Rocketdyne Santa Susana Propulsion Field Laboratory.

The F-1 burns RP-1 and liquid oxygen supplied by a 60,000 hp. turbopump capable of moving three tons of propellant per minute. The turbine is spun by a 10-in.-dia. regeneratively cooled gas generator burning a fuel-rich mixture of propellants from the main tanks. About 2% of total propellant consumption goes to the turbopump. The pump is a novel axial flow design adopted to cope with the difficulty of moving propellants at such an extremely high rate. The engine is controlled by a single gas generator propellant flow regulator, a gas generator valve, four-way solenoid valve and four propellant valves. The solenoid and the spark exciter for starting the engine are the engine's only electrical components.

General Dynamics Credits

General Dynamics Corp., faced with new write-offs in its commercial jet program (AW Aug. 14, p. 37), reached agreement with a group of banks headed by Chase Manhattan for a $200-million two-year revolving credit. The agreement restricts payments of dividends on common stock during its two-year life.

Management shakeups, heretofore largely involving the former Convair Division, are continuing in the corporation. James D. McLean, president of General Dynamics/Electronics, the former Stromberg Carlson Division, resigned last week. His place is being filled temporarily by W. P. Gullander, one of two recently appointed executive vice presidents of the corporation. Jack T. Anderson, vice president-marketing for the Electronics Division, also resigned.

British Merger

London—Armstrong Whitworth Aircraft and Gloster Aircraft, both members of the Hawker Siddeley Aviation Group, last week were merged to form Whitworth Gloster Aircraft.

Gloster, builder of the Javelin all-weather fighter for the Royal Air Force, recently confined its aviation activities to subcontract work on metal cutting for the Avro 748 and Armstrong Whitworth Argosy turboprop transports.

Policy-Making Change Outlined by McNamara

Washington—Main change made by the Kennedy Administration in the nation's top policy-making machinery is that responsibility has been shifted from committees to "individuals, specific individuals," Defense Secretary Robert S. McNamara said in Senate testimony released last week.

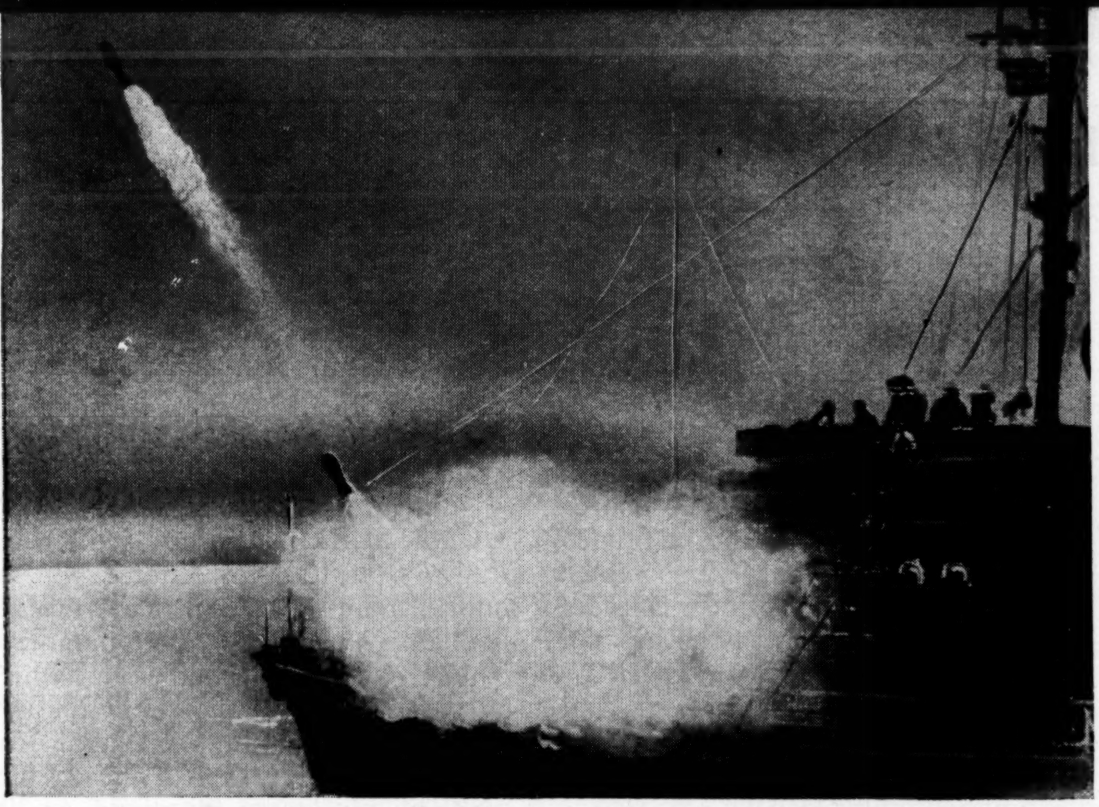
The result, McNamara said, is that now the President is presented with a program on which there is wholehearted agreement by all concerned—or he is presented with divergent views.

"The committee system led to an attempt to achieve a unanimous position," McNamara told the National Policy Machinery Subcommittee. "In order to accomplish this it was frequently necessary for particular parties to dilute their proposals and points of view down to what might be called the lowest common denominator and this was presented to the President as an agreed-upon position.

"In contrast to that, today the responsibility is assigned to a specific individual, the Secretary of Defense or the Secretary of State . . . who is responsible for preparing a recommendation, his own recommendation, and for reviewing that with the other parties concerned and obtaining from them either agreement to his position or alternatively, a statement of their position, and in the latter case the conflicting views are presented to the President." McNamara noted the extensive use of "task forces" by top Administration officials to obtain the best advice available in the nation.

McNamara also told the subcommittee, headed by Sen. Henry Jackson (D.-Wash.), that:

- **National Security Council** meetings are now held frequently but irregularly —sometimes three times a week, sometimes only once in two weeks. They are called to consider "particular problems at particular times." The Administration has abolished the NSC's inter-agency Planning Board which the Jackson subcommittee criticized as a policy paper production mill that aimed at agreement rather than the best solution (AW Dec. 26, p. 17).
- **Political guidance**—Necessarily "shifting guidance"—is given by State Department to Defense Department. Recognizing State's problem in predicting situations, McNamara commented: "We in Defense . . . are quite willing to adjust our plans as the guidance changes, as it must."
- **Defense Intelligence Agency**, which will become operational Oct. 1, will report directly to the Joint Chiefs of Staff. McNamara said that it is not yet "entirely clear" how extensively intelligence activities will be shifted from the three services to the new agency. He said Defense's intelligence activities will be directed to the carrying out of specific military missions, and will include the location of military installations, the quantity of weapons, and the order of battle of the opponents' forces.



Russians Fire Anti-Sub Rockets

Heavily retouched photograph released by Soviet authorities shows two small rockets being launched from the deck of a small Soviet ship during rehearsal for Soviet Navy Day show held recently. (AW Aug. 7, p. 29).

Project West Ford Approved; Wiesner Reassures Astronomers

Washington—Air Force has received presidential approval to proceed with its Project West Ford experiment to orbit 75 lb. of hair-thin metal dipoles to investigate their use as a passive communications satellite technique (AW July 24, p. 23). But optical and radio astronomers have received government assurance that the U.S. will not conduct space experiments with indifference to their scientific consequences.

The action followed a study by a special committee established by the Space Science Board of the National Academy of Sciences, which indicated that a single experiment would not have a serious effect on optical or radio astronomy. The committee, whose members included outstanding U.S. astronomers, cautioned that an operational system involving a larger, more dense belt of orbiting dipoles might interfere with astronomy.

Dr. Jerome B. Wiesner, the President's special assistant for science and technology, said in a letter dated Aug. 11 that the government's policy is the following:

- "**No further launches** of orbiting dipoles will be planned until after the results of the initial West Ford experiment have been analyzed and evaluated. The findings and conclusions of foreign and domestic scientists (including the liaison committee of astronomers established by the Space Science Board) should be carefully considered in such analysis and evaluation.
- "**Any decision to place** additional quantities of dipoles in orbit, subsequent to the West Ford experiment, will be contingent upon the results of the analysis and evaluation and development of necessary safeguards against harmful interference with space activities or with any branch of science.
- "**Optical and radio-astronomers** throughout the world should be invited to cooperate in the West Ford experiment to ascertain the effects of the experimental belt. . .[and] should be given appropriate information on a timely basis. Scientific data derived from the experiment should be made available to the public as promptly as feasible after launching."

The concept of an orbiting belt of metal reflecting dipoles to serve as an artificial ionosphere at microwave frequencies was developed by Lincoln Laboratory. Calculations indicate that 400 million dipoles, weighing about 75 lb. and dispensed from a rotating mechanism that will give them rotational velocities of up to three meters per second, will produce a belt that will circle the earth in about a month. Belt width is expected to be about 25 mi. after two months (AW Aug. 22, 1960, p. 105; Sept. 19, p. 30).

The orbiting belt of dipoles would provide the service of a low-altitude passive communications satellite, but with several important advantages. There would be no need to track a moving satellite and the belt would provide continuous service between terrestrial points within its view.

Apollo Lunar Engine To Handle Five Jobs

Washington—Lunar propulsion module, which will be the main propulsion system for lunar landing missions of the Apollo manned spacecraft, will be requested to perform a variety of jobs:

- **Translunar midcourse** velocity control.
- **Lunar orbit injection.**
- **Lunar orbit retrofire.**
- **Hovering descent** to the lunar surface.
- **Lunar liftoff** and return to earth.

In specifications for bid requests recently issued to industry (AW Aug. 14, p. 37; Aug. 7, p. 29), the National Aeronautics and Space Administration described the two propulsion systems to be used on Apollo—a large liquid hydrogen-liquid oxygen powerplant, to be used only on lunar landing missions, and a smaller unit to be used on extended earth orbit, circumlunar and lunar landing flights.

On extended earth orbit missions, the smaller—or terminal—propulsion system will be used for retrofire to bring the Apollo out of orbit and to place it along a ballistic re-entry trajectory. On circumlunar and lunar landing flights, this system will provide midcourse correction, earth orbit injection and earth orbit retrofire. Just prior to re-entry, it will be jettisoned.

NASA has not stipulated the type of engines to be used in the terminal system, but is reported to favor a system utilizing storable propellants.

The lunar propulsion module, fitted to the Apollo vehicle beneath the terminal propulsion pack, will serve the dual function of powering lunar landing and take off. Once over the moon's surface, this system must be able to hold the Apollo vehicle at zero forward velocity, after an altitude of 100 ft. has been reached. Descent to the surface, at 100 ft./min., is to be slow, with a translation (horizontal drift in any direction) no greater than 1,000 ft. during any 30-sec. period. The propulsion system must also maintain the vehicle in an abort attitude, with the terminal engines presumably used for escape of the spacecraft from the lunar propulsion stage in case of abort.

At liftoff from the lunar surface, the lunar propulsion system must be able to impart a velocity up to 6,600 fps. to the earth-returning Apollo.

NASA also has specified. an escape tower for the Apollo vehicle for use in the event of abort during the earth boost phase. The tower will use a solid propellant motor.

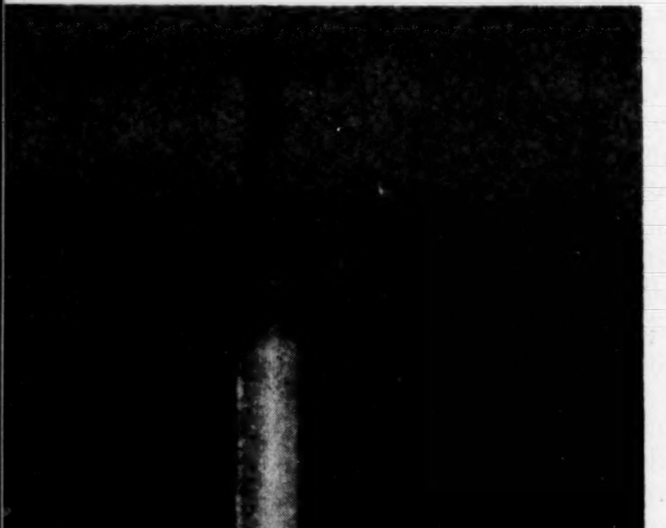
On Lunar landing and circumlunar flights, the Apollo probably will not carry a laboratory module. The mission-command module will have an instrument payload capability of 400 lb.

French Pressing IRBM Pace Despite U.S.

Paris—French government is pushing ahead with development of its nuclear armament despite the Kennedy Administration's reluctance to lift a 1959 ban which prohibits U. S. companies from cooperating with the French on such projects.

French had hoped President Kennedy's visit to Paris last May would bring about a change in U. S. attitude. U. S. companies, told by Washington in 1959 to cease working with the French on nuclear vehicle projects, also had hopes they might be permitted to resume such activities.

So far, however, and despite some U. S. sources who vaguely claim something may be done, the Kennedy Administration has maintained the no cooperation principle laid down by former President Eisenhower.



AGATE MISSILE, one of two fired recently by French in the Sahara, rises on a flight which carried it to 40-mi. altitude.

In particular, French could use U. S. technical aid in their intermediate range ballistic missile development, as well as enriched uranium fuel for their nuclear submarine plans. U. S. technical aid on the missile vehicle could be given by executive decision. Nuclear fuel elements for French subs would require congressional approval. Sources close to these projects claim the French, even without U. S. aid, will complete them. But to do so will take considerably longer—and involve more expenditure—than if U. S. help were given.

The U. S. ban on American companies working with the French on missile vehicle projects was quietly laid down in September, 1959, (AW Dec. 7, 1959, p. 29). At that time several U. S. missile companies already were deeply involved in talks with the Societe pour l'Etude et la Realisation d'Engins Balistiques (SEREB), a combine of French companies set up earlier in 1959. SEREB's main mission is to coordinate efforts of French companies taking part in the IRBM project, as well as to deal with U. S. or other foreign companies which could aid the project. The 1959 ban, reportedly agreed to by both Pentagon and State Department officials, squelched all working arrangements between U. S. companies and SEREB.

Reportedly, motivation behind the present Administration's reluctance to cooperate with the French on nuclear armaments is different from that of former President Eisenhower's.

The latter, in an important NATO summit meeting in December, 1957, agreed to help NATO develop an advanced type weapon such as an IRBM. It was thought this was the best way to meet NATO members anxiety about having to rely solely on U.S. nuclear armament. Having thus decided, it was only logical the Eisenhower Administration would refuse, as it did, to help any single NATO member, such as France, develop its own nuclear weapons.

With the Kennedy Administration, however, French feel that main motivation is Washington's desire to prevent proliferation of nuclear armament, either via a NATO-wide group or by helping a single nation such as France.

Whatever the reason, French officials are no longer counting on U. S. aid. Many of them, in fact, take a special pride in France achieving its nuclear posture on its own. In any case, here is how French independent nuclear armament plans are shaping:

- **IRBM**: SEREB's work in this field is, of course, classified. French, however, still are planning to have an IRBM weapon ready sometime between 1968-70. Present planning calls for a solid-fueled missile with a range of 1,500-2,500 mi. Missile would be equipped with nuclear warhead using enriched uranium produced by a $30-million isotope separation plant being built at Pierrelatte, in southeastern France. Completion date for this plant is given as sometime in 1966.
- **Until SEREB develops** its IRBM, France's nuclear strike force will be built around Mirage IV twin-jet bombers carrying plutonium-type bombs. Mirage IV bombers, of which 50 are being built at a cost of $200 million, are scheduled to be operational by 1965. France already has limited supplies of plutonium produced at its atomic center at Marcoule.

While SEREB officials readily admit their task would be a lot easier if U. S. aid were forthcoming, there is general satisfaction with missile development to date. First SEREB test missile recently was launched in the Sahara (see photo). Called Agate, the single stage missile was propelled by a solid fuel element weighing two metric tons, the heaviest solid fuel charge yet to be fired by France. Two firings of the non-guided Agate were made. Instrument payload weighing 1,650 lb.—the largest French payload to be lifted to date—was carried to an altitude of 40 mi.

SEREB officials did not specify whether Agate is a forerunner of IRBM weapons, or whether it is merely a scientific test missile. In addition to military missiles, SEREB also can get involved in purely scientific rocket work —although building France's IRBM weapon is its main mission.

- **Nuclear submarines:** In the field of nuclear propulsion, U. S. aid is restricted to limited supplies of U-235 for landbased prototype reactors. No technical information is being given the French nor can the French get enriched uranium fuel elements for seagoing submarine reactors.

Thus the French Navy, working with the French Atomic Energy Commission, is developing a full scale, landbased prototype of a submarine nuclear powerplant at Cadarache. The reactor will be a pressurized water type with power output comparable to the American Skipjack class. Fuel will come from the U. S. but the reactor design will be French. Prototype is expected to be completed by the end of 1963.

Funds for France's first nuclear-powered sub are included in the 1960-64 French armament program. Just how many nuclear subs the French can build depends on their capacity to produce enriched uranium at the Pierrelatte plant.

NASA Launches Explorer XII To Measure Energetic Particles

Washington—Explorer XII, an omnibus satellite for a variety of radiation experiments, was launched into a highly eccentric orbit last week from Cape Canaveral by the National Aeronautics and Space Administration.

Placed in an orbit with 170-mi. perigee and a 50,000-mi. apogee by a three-stage Thor Delta launch vehicle, Explorer XII was the first of a series—designated S-3—of four satellites which will investigate solar plasmas, cosmic radiation, interplanetary magnetic fields, the extent of the earth's magnetic field and the charged particle population both in space and in the Van Allen radiation belts.

In the course of its 31-hr. orbit, the satellite is expected to pass twice through these radiation belts. The Explorer is equipped with four solar paddles containing 5,600 solar cells, and a 2-watt, 136-mc. transmitter, providing 50 telemetry bits per second.

The octagonal-shaped, 83-lb. satellite carried the following experiments:

- **Proton analyzer** built by NASA's Ames Research Center. This 1-lb device will measure the low-energy proton flux and spectrum from 1,000 to 40,000 mi. Data on these particles, believed to constitute 85% of the energized matter in space, will provide knowledge of proton concentrations in solar winds and will be indicative of particle activity in the Van Allen radiation belts during solar disturbances.
- **Magnetometer,** developed by the University of New Hampshire. This magnetic field experiment, contained in a 640-gram sensor unit and a 760-gram electronics package will measure the magnitude and direction of the earth's magnetic field between 12,000 and 40,000 mi. The instrument also will investigate the possibility of the earth's magnetic field terminating at 40,000 mi. and all this data will be used to evaluate theories of extra-terrestrial current systems and magnetic disturbances, especially as they correlate with solar occurrences.
- **Trapped particle radiation** device built by the State University of Iowa. The four Geiger counters in this instrument will measure protons above 20 mev. and 50 mev. and the electrons between the bands 40-55 kev., 90-100 kev. and above 2 mev. and 10 mev. The three cadmium sulphide cells will measure the total energy flux of protons and electrons and low-energy proton detection. Total weight of this instrument is 3,069 grams.
- **Cosmic ray indicator,** built by NASA's Goddard Space Flight Center. This instrument, comprising a 20-in-long, 2.5-in.-dia. double telescope, a single cesium iodide crystal detector and a second 5.2-in.-long, 2.5-in.-dia. telescope, will measure the charge and energy spectra of cosmic radiation as a function of time, direction and distance from earth. Since many solar-related phenomena are transmitted by solar plasma, NASA feels that this device also should give magnetic field and plasma data.
- **Ion electron detector,** prepared by Goddard. This unit, weighing 1,362 grams, will measure the fluxes, types and energies of particles in, above and below the Van Allen radiation belts as a function of direction, time and position.
- **Solar cell instrument,** developed by Goddard. Consisting of four strips of 10 silicon solar cells each, this device will measure deterioration effects of cells exposed to the Van Allen radiation belts. One strip is unprotected; the other three are covered by 3-, 20- and 60-mil-thick glass plates to determine the effectiveness of glass filters.

Russia Considering Opening Space Shots

Washington—Soviet Russia has begun making plans to allow foreign correspondents to witness launchings of its space rockets—but this may not be done until, and unless, agreement is reached on total disarmament.

Leonid I. Sedov, head of the USSR Academy of Sciences' interplanetary travel committee, told 1,500 newsmen and scientists who attended a press conference in Moscow Aug. 11 to hear details of Maj. Gherman Titov's orbital flight of the earth that these plans are under way.

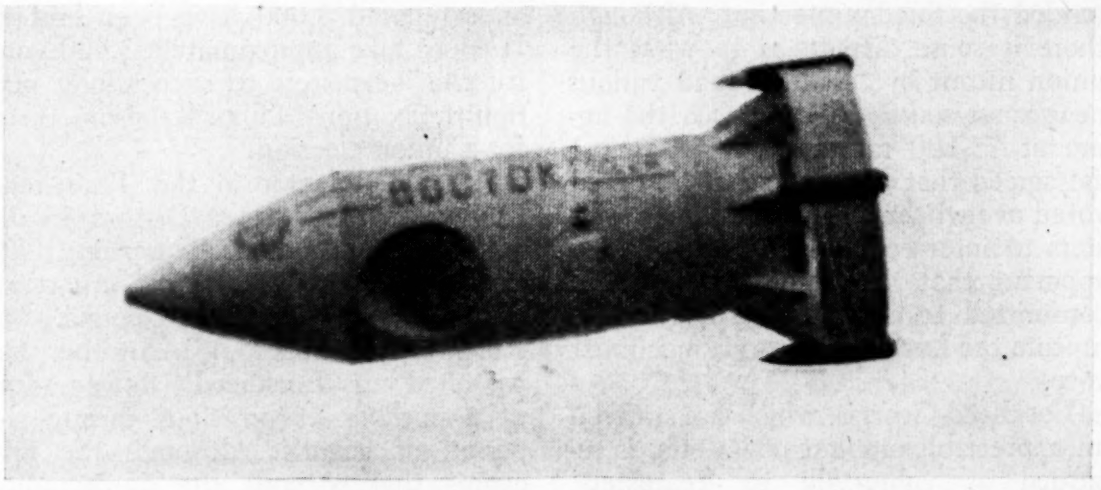
But he said: "You must understand, a carrier rocket does not have only peaceful purposes. If the Americans had such perfected carrier rockets, they too would not have revealed them, just as they have many things they have not revealed." Sedov did not specifically tie watching of Soviet space shots to disarmament, but he said only after disarmament will there be "no barriers for science."

Maj. Titov said, in answer to a question, that Soviet space explorations serve solely peaceful purposes, and "the ship Vostok II has not been developed, has not been adopted for the purpose of carrying bombs."

Titov said his first impression of weightlessness was that he was flying with his feet upward, but this sensation did not last long. Prof. Vladimir I. Yazdovskiy told the conference that Titov's "sustained weightless state caused certain changes in his vestibulary system which at times gives rise to unpleasant sensations." This organ of the ear helps to control the sense of balance. After Titov assumed his regular position and made no further abrupt movements, the symptoms almost disappeared, Prof. Yazdovskiy said. "After sleep, these changes diminished considerably and disappeared completely after the braking system was switched on," the professor said.

Titov said he had no particular appetite, but said this may have been due to excitement. He never closed the helmet of his space suit, took no sleeping pills, signed a few autographs while he orbited the earth, kept a log and took pictures with an ordinary press camera, he said.

When a reporter asked if vodka increased the sensation of weightlessness in space, since it produces "the same effect on earth," Titov replied: "To tell you frankly, I did not try. I leave this opportunity to you. Try it and find out."



SOVIET Cosmonaut Gherman Titov told newsmen in Moscow that he ejected his seat from the Vostok II spacecraft late in his descent and landed by parachute. He did not make it clear whether the chute is attached to the seat or is a personal chute. Ejection, used in at least one orbital animal flight, probably is through hole seen here in the craft displayed at the recent Tushino air show, which Soviets said was Vostok I.

Lockheed F-104Js Prepared for Delivery to Japan

Lockheed F-104J Super Starfighter bearing insignia of Japanese Self Defense Force takes off from Lockheed test station at Palmdale, Calif. Lockheed will build 23 of the fighters and Mitsubishi Heavy Industries Reorganized will build an additional 177 aircraft under license. Plane was flown by Lockheed test pilot Charles A. Kitchens. Main difference between earlier versions of the F-104 and the F-104J is inclusion of a different fire control system, gunsight, bomb computer and the North American search and ranging radar. The F-104J is somewhat heavier than the U. S. version but will perform at about the same speed.

Teamsters Open Bid to Organize Lockheed-Georgia Defense Plant

By Arnold Sherman

International Brotherhood of Teamsters' effort at organizing the Lockheed-Georgia Division follows an announcement by James Hoffa in Miami last month that his union will move into defense industries. Lockheed-Georgia is the first aircraft plant targeted by the Teamsters.

The Teamsters named Lockheed's International Assn. of Machinists' Local 33 as their immediate objective recently after a meeting at the union's Atlanta, Ga., headquarters. According to Robert Cook, president of the Teamsters' Atlanta operation, 125 leaders from various Lockheed production departments attended the Sunday meeting. Although there is some dispute as to what the union meant by "leaders," and various newspaper sources have pegged the figure at 75-100 rather than 125, most are agreed that the workers represented voted overwhelmingly to ask the Teamsters to intervene. Also it has become apparent that the Teamsters now are committed to a strenuous program to capture the Lockheed-Georgia machinist vote.

Lockheed-Georgia, which has suffered an appreciable amount of lay-offs, is regarded as vulnerable to Teamsters' intervention. Over the three preceding years, according to Lockheed sources, the labor force dwindled from 20,000 employes to 10,000. The situation has improved, however, to the extent that 11,000 workers are now employed in the Georgia facility. With accelerated C-130 production approved by Congress, Lockheed sources are reasonably confident that the labor situation will take an added upturn although it is doubtful that the labor force will increase much beyond the 12,000 mark in the near future.

Since workers laid-off normally preserve their right to exercise a vote in selecting a union, the unemployed workers, and particularly in this case that proportion of those workers who are members of the IAM, could play a key role in union organizing. There were 8,000 dues-paying members of the IAM working at the Georgia plant. Of these an estimated 3,000 have been laid-off. It could take approximately 3,000 votes for the Teamsters to successfully petition the National Labor Relations Board for a union election.

An added factor in the Teamsters/IAM controversy was a District 33 dispute over management. The parent IAM body, however, did send its own representative to Lockheed-Georgia "to straighten matters out." Another factor cited was Lockheed's downgrading of a number of positions during the period of lay-offs. Although the firm claims that without the downgrading action, more workers would have been released, some workers have objected to the action.

Local IAM leaders are calling on the AFL-CIO to organize in the Teamsters' bailiwicks as a method of putting the Teamsters on the defensive—thus relieving the machinists' local of some pressure.

The machinists' union has a contract with Lockheed effective until July, 1962. This, however, does not preclude the fact that inasmuch as the NLRB calls for union elections between 60-120 days prior to the signing of a new contract, the next months will see an increasing effort on the part of the two unions involved to line up as many votes as possible.

Of the 100-odd employes who form the nucleus of the Teamsters' effort to organize Lockheed-Georgia and unseat the IAM, many are described as those who actively agitated against present IAM officials in the last union elections for officers. The dissatisfied Lockheed workers are led J. B. Sellers who was defeated by IAM district president E. A. Demcheck in the last election. Last year local IAM members accused Sellers of dual unionism (an inference was drawn that he would lead the union into the Teamsters camp if he was elected), and the national IAM headquarters declared Sellers ineligible to hold any union office for a period of five years.

The Teamsters, who deny that they are raiding and insist instead that they have been asked to intervene by dissatisfied IAM members, scheduled another meeting late last week. Local IAM officials are claiming, however, that workers are being paid for each new member they enroll in the Teamsters' corner and that, in fact, a $1-million war chest has been set aside by the Teamsters for the "Lockheed-Georgia takeover."

NATO Invitations Out For V/STOL Fighter

North Atlantic Treaty Organization has sent out invitations to selected contractors asking for formal bids on both the long-awaited NATO V/STOL close-support fighter competition and for a V/STOL transport aircraft. Deadline for the transport bids is mid-November; for the close-support fighter, Dec. 31.

A number of U. S. as well as European firms have been invited to submit proposals, although the NATO specifications for the two aircraft emphasize that a consortium bid by several industries in various countries will be favored. A Pentagon briefing of interested U. S. industry representatives is scheduled to be held on Aug. 24.

News Digest

First Saturn S-I booster arrived at Cape Canaveral Aug. 15 aboard the Navy barge Compromise after a 10-day, 2,200-mi. trip from the Marshall Space Flight Center. Launch of the S-I with inert upper stages and payload is scheduled for later this year.

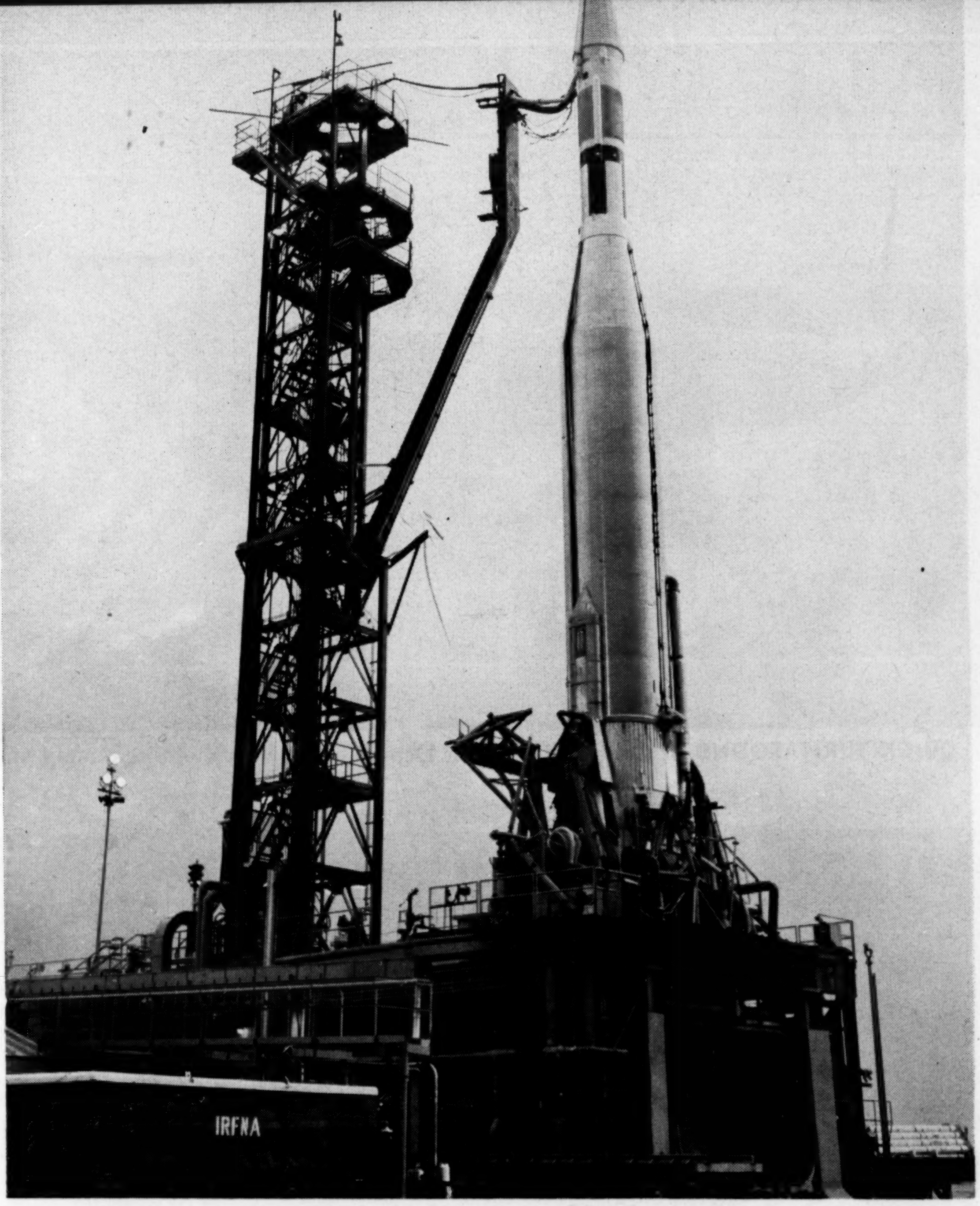
Adm. James S. Russell, former vice chief of naval operations, has been named commander of all North Atlantic Treaty Organization forces in southern Europe, replacing Adm. Charles R. Brown who retires Jan. 1.

New world's speed record of 664 mph. over a 9 to 12 mi. course for a seaplane has been claimed by the Soviet Union. The plane, identified by Moscow radio only as having flown in the Tushino air show last month, is apparently the Be-8 (AW July 24, p. 30).

Second attempt to orbit an S-55 micrometeoroid satellite is scheduled for this week at National Aeronautics and Space Administration's Wallops Island, Va., station. First attempt, last June 30, failed when the third stage of the four-stage Scout vehicle did not ignite. Present payload has been used in ground environmental tests. Orbit is expected to be 280 stat. mi. at perigee and 610 stat. mi. at apogee.

Boeing Co. will remove wing center sections from B-52G and B-52H aircraft and run flex tests on the panels to gather stress data, under a $18.3-million USAF contract. Work will be done at Boeing's Wichita, Kan., plant.

Prototype Beagle 206 twin-engine executive plane (AW Aug. 7 p. 29) made its first flight Aug. 15, but will not be shown publicly until Sept. 4, at the Farnborough air show.



Ranger to Be Launched by Atlas-Agena

Ranger deep space probe, forerunner of lunar impact vehicles, is now scheduled for launch this week aboard an Atlas-Agena vehicle from Cape Canaveral, Fla. Jacket around upper end of payload section is a plasticized blanket through which cooled nitrogen is circulated to maintain temperature for instruments inside. Blanket is disconnected just prior to launch.

Avco's Lycoming Division and FMC Corp. have been selected by Navy from among 11 bidders to build one prototype each of a Landing Force Amphibious Support Vehicle, Hydrofoil (LVH). Avco's $1,385,000 contract calls for a vehicle using two submerged foils. FMC's $1,158,000 contract calls for a vehicle with one surface-piercing foil forward and a submerged foil aft. Speed is to be 35 kt. and above on water and more than 25 kt. on land.

McDonnell Aircraft reported final earnings after taxes for the fiscal year ended June 30, 1961 were at a new high of $12,109,357 as compared with $12,087,025 for the previous year. Earnings per share for Fiscal 1961 were $3.54 compared with $3.55 for the previous year, based on 3,425,445 shares outstanding on June 30, 1961, and 3,402,490 on June 30, 1960.

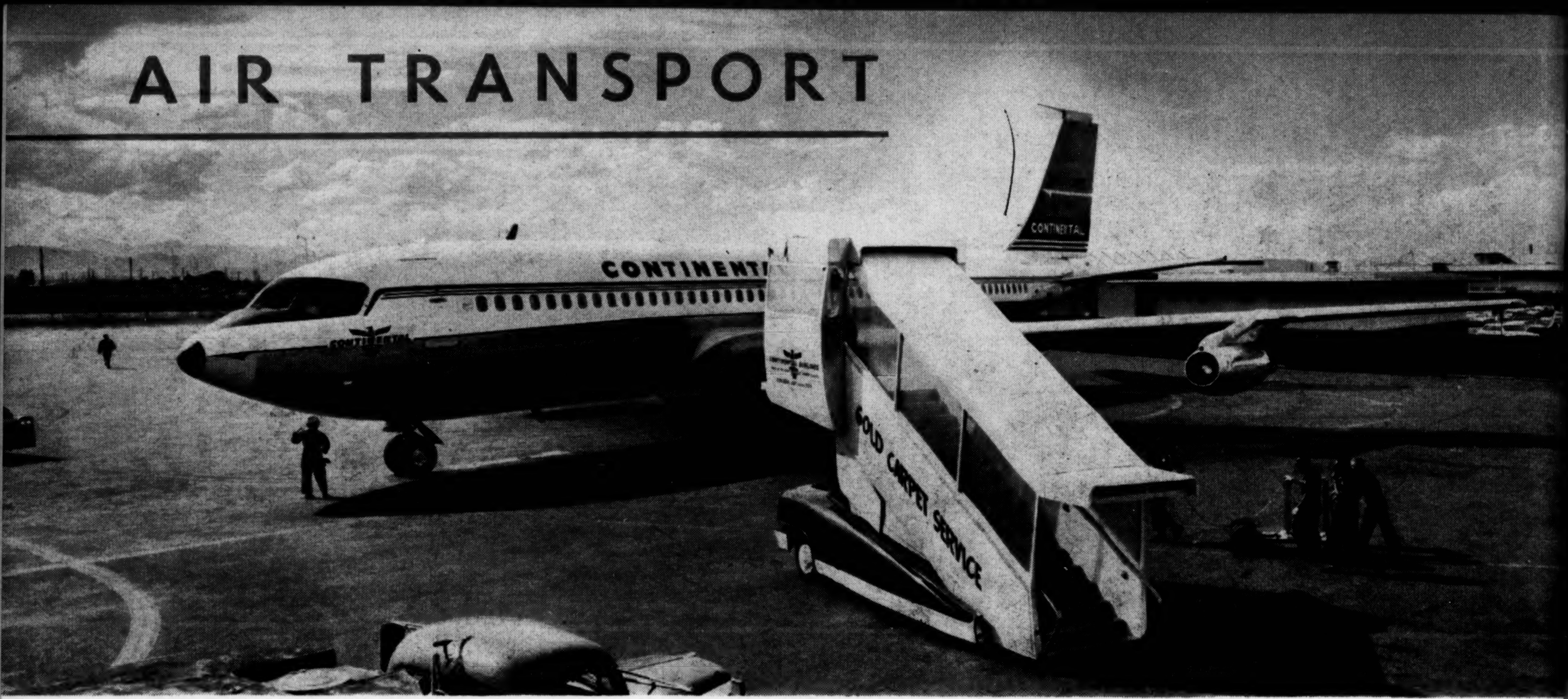
Navy-Douglas A4D-5, a longer-range higher-payload modification of the A4D Skyhawk powered by the Pratt & Whitney J52-P6 engine, has made its first flight at Edwards AFB, Calif.

Lt. Gen. Joseph F. Carroll, inspector general of the Air Force and organizer after World War II of USAF's Office of Special Investigations, has been named director of the new joint Defense Intelligence Agency.

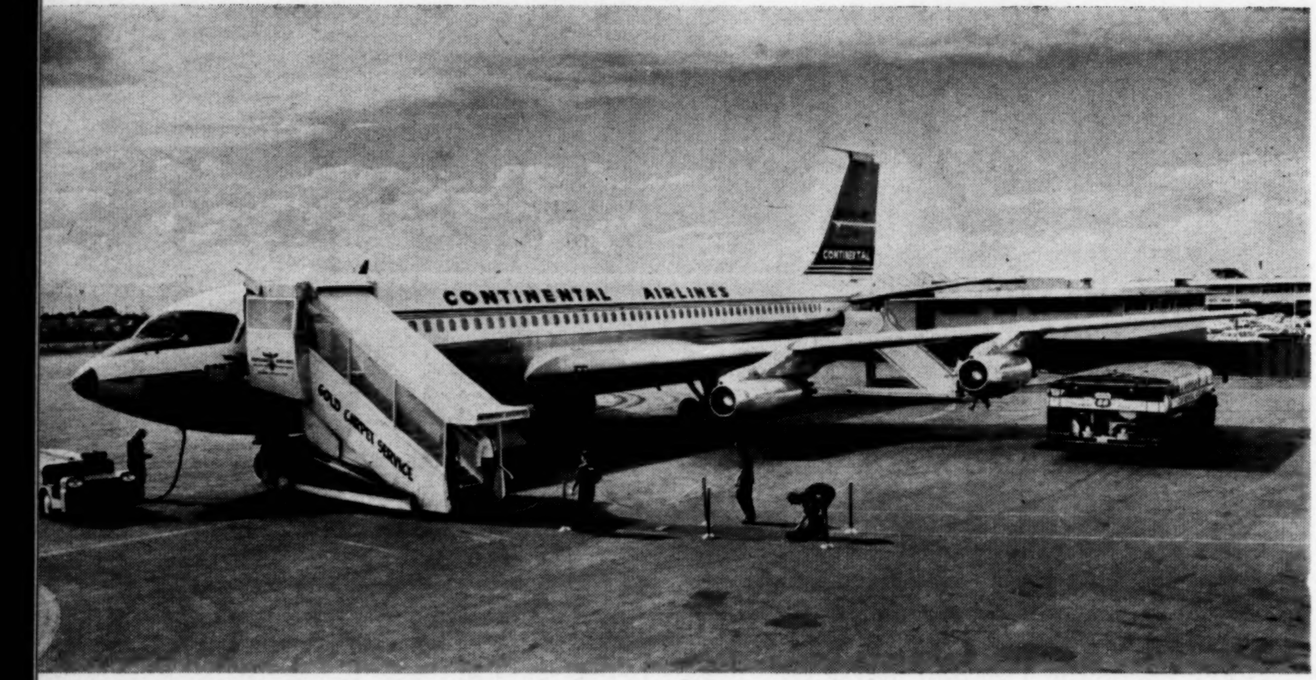
Bell YHU-1D made its first flight at the company's Hurst, Tex., plant Aug. 16, opening Phase I of its test program. Powered by an 1,100-shp. Lycoming T53-L-9 turbine engine, the latest version of the Army's Iroquois helicopter series is designed to carry a pilot and 12 fully-armed troops. Cabin area of 220 cu. ft. is available, compared with 140 cu. ft. in earlier models, through relocation of fuel tanks.

General Electric Co., Missile and Space Vehicle Dept. has received a $1,133,000 Air Force contract for research and development on the Samos II program.

AIR TRANSPORT


CONTINENTAL
GOLD CARPET SERVICE

QUICK TURNAROUND of Continental 707 at Denver begins with motorized ramp moving to front hatch, followed by crew with gol


CONTINENTAL AIRLINES
GOLD CARPET SERVICE

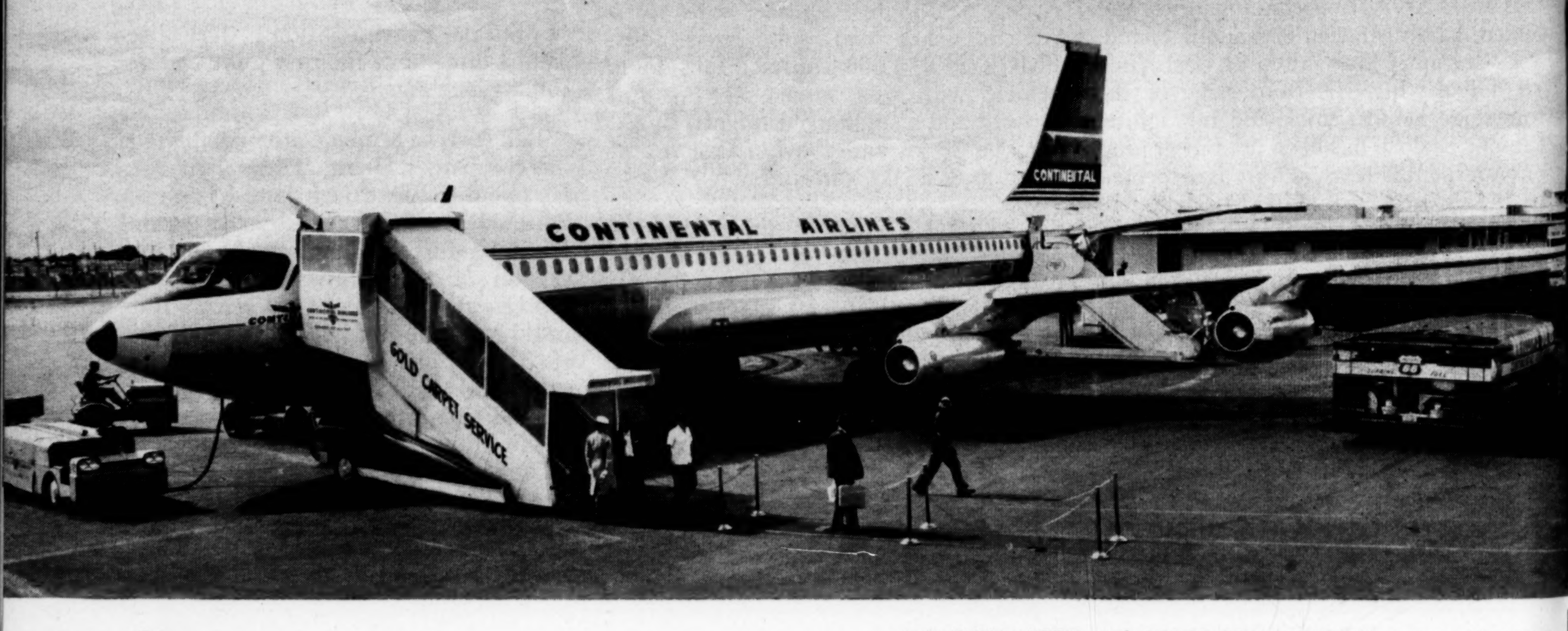
Jet Utilization

By Robert H. Cook

Denver—Continental Airlines' intense efforts to maintain a steady profit level during the jet transition has made it a focal point of competitive concern and curiosity because of its ability to achieve unusually low breakeven load factors while improving the quality of its scheduled service.

The Continental formula, which concentrates on holding all costs to a predetermined minimum while squeezing the maximum revenue production from the fleet of five Boeing 707-120s and 13 800 series Viscounts that provide

AS FUEL TRUCK STOPS, (above) power unit connection is completed, and ramp operator descends. Below left, baggage cart approaches.


CONTINENTAL AIRLINES
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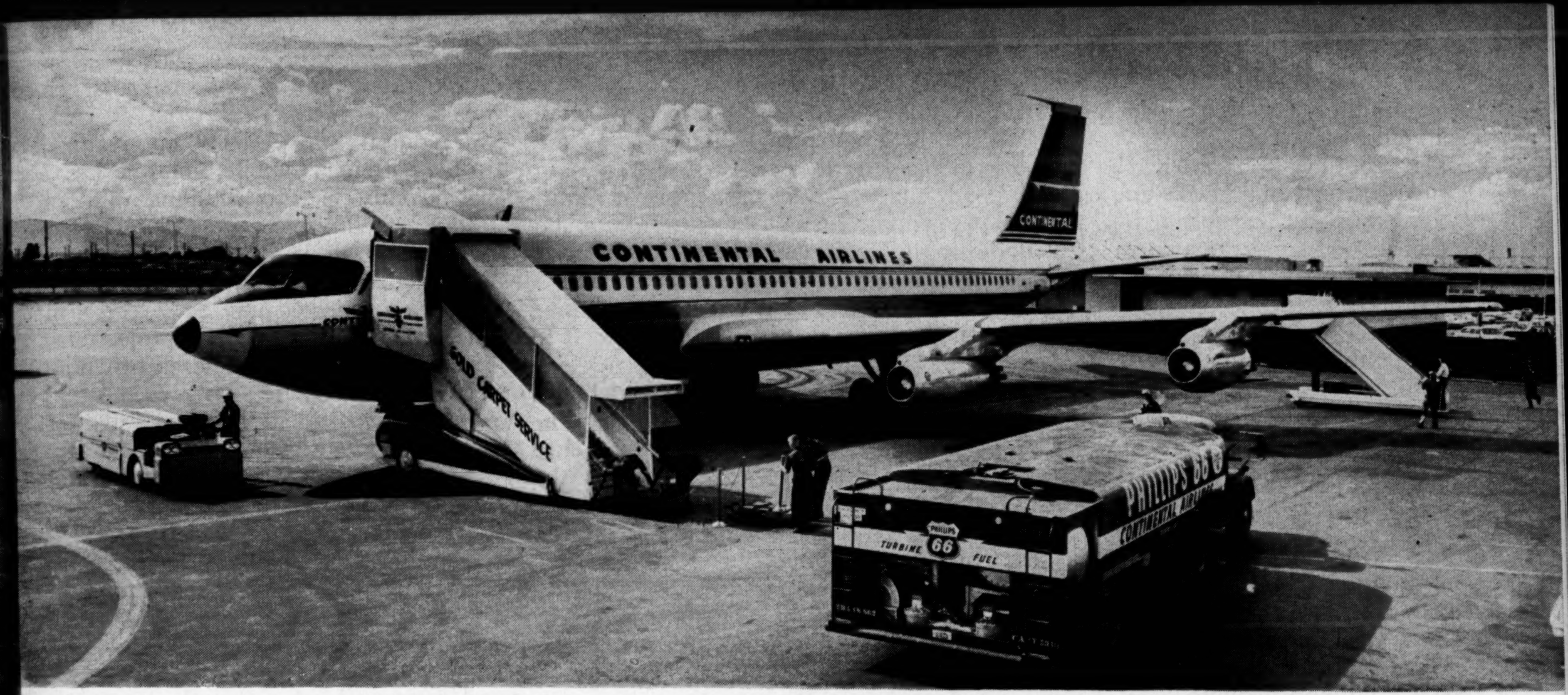
GOLD CARPET SERVICE



carpet. Power unit approaches from left and fuel truck moves outboard of No. 4 engine pod. Second ramp approaches rear hatch.

Cost Control Increase Continental's Profits

90% of the daily seat miles, has catapulted the airline from a net loss position of $132,000 in 1958 to a healthy $1,705,280 net profit in 1960.

The balance of Continental's service is provided by five Douglas DC-7s, a DC-6B and five leased DC-3s. Future plans call for a quick phaseout of most of this piston equipment, which the airline feels is too costly to operate.

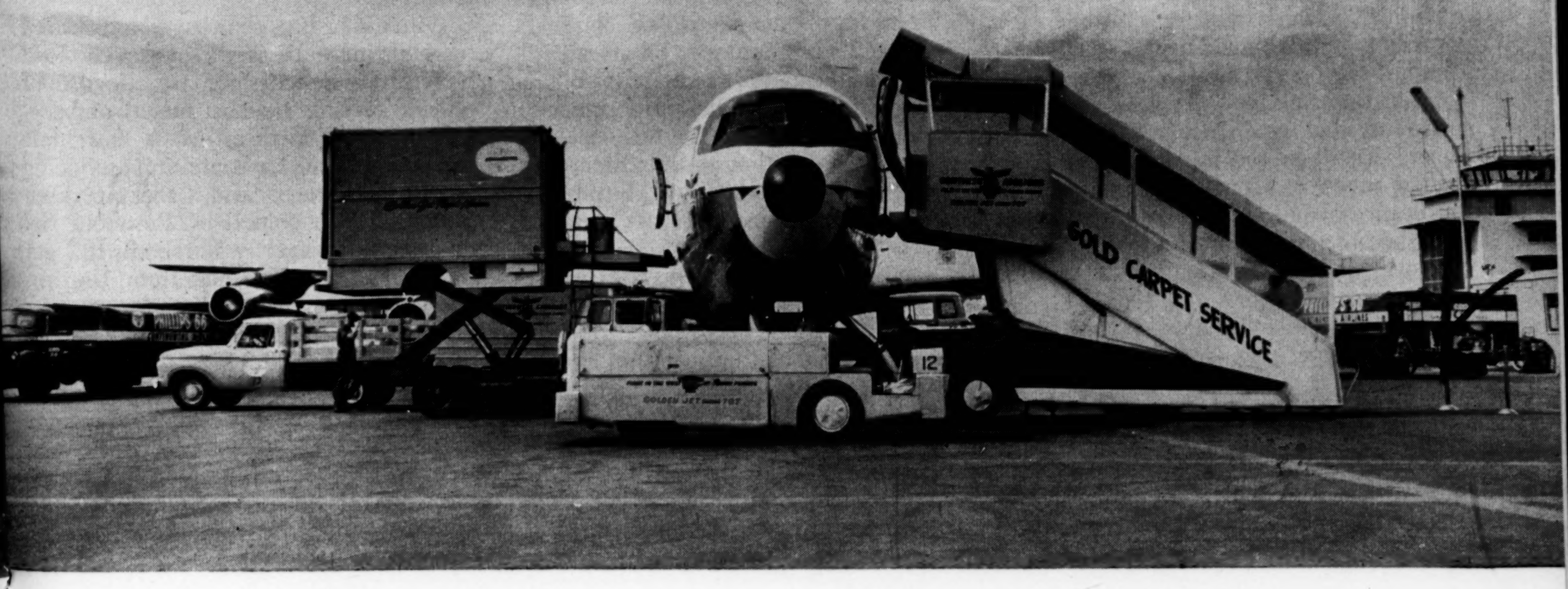
Faced with heavy competition from American Airlines, United Air Lines and Trans World Airlines over its most productive routes—predominantly from Chicago to California—Continental has carefully tailored its entire operation toward proving that the high revenue potential for turbojet aircraft must set the pace for all other operations.

Following this basic premise, Continental has consistently increased its average daily aircraft utilization and lowered the breakeven load factor to a point where its Boeing 707 turbojets last year turned in an actual utilization rate of 10 hr. 51 min., the highest in the industry. This figure now stands at 14 hr. and 48 min. with new service between California and Texas, and was scheduled to reach 15 hr. with the inauguration of new service between Kansas City, Denver and El Paso.

High utilization implies low load factors. Thus Continental's drive toward high utilization carries the essential corollary of strict cost control to provide correspondingly low breakeven load factors.

As an example of the rewards possible with this philosophy, Continental points to 1960 year-end figures. These show that while its actual 50.3% system load factor was the lowest among 12 domestic trunk operators, its breakeven load factor of 44.6% produced an operating profit equal to 10% of the airline's gross sales of $61 million. Computed from Civil Aeronautics Board fig-

itchen trucks are in position on aircraft's right. Front view shows two fuel trucks in position, kitchen truck elevated.



ures, this profit ratio was the highest among the seven trunks which showed a profit.

By continually expanding this gap between actual and breakeven load factors, which last year spanned 5.7 points, Continental expects to increase its profit margins and meet all competition. This spread has in the past given Continental a breakeven load factor advantage of more than 13 points over such major trunks as Northeast Airlines, 12.2 over National Air Lines, 8.4 over Eastern, 2.2 over United and 1.4 over American.

Current figures show that Continental has an actual system load factor of 48.9% so far this year, with a breakeven load factor of 42.5% which is expected to drop below 42% by the end of this year. During the month of June the airline's breakeven load factor dropped to 34.3% on the Boeing 707s and to 41.4% on the Viscounts.

Operating Income Gain

Another important segment of Continental's formula, which produced a 66.4% gain in net operating income last year, is turning its size to advantage. Continental's top management is closely knit, and department heads have ready access to and backing from Robert F. Six, president of the airline for the last 16 yr., and Harding L. Lawrence, executive vice president.

The airline's net income of $1.7 million last year included only $200,000 from the sale of two surplus Viscounts, as compared with a $1.6 million capital gains realized in 1959, and Six is confident that Continental's earning powers will continue to grow. He cites the airline's recent order for four Boeing 720B turbofan aircraft, at a cost of $27.5 million. They are scheduled for delivery during the second quarter of next year. The more economical aircraft, capable of using 5,000-ft. runways at sea level, will be used over the company's new California-Arizona-Texas route awarded in the Southern Transcontinental Case. Addition of the new points expanded the airline's route system to 7,000 mi. on a daily schedule providing 6,250,000 seat miles to 36 cities in nine states.

At the same time, Six is a realist, cautioning that experience with the turbojet "is still in the learning curve" and that much of Continental's success in advance planning and daily cost control is because the work force—3,000 employes—is relatively small in relation to the route mileage.

He sees a definite need to drop many of the carrier's smaller, less productive points as it did with 10 cities under a CAB order in the Kansas-Oklahoma case. This eliminated the need for five leased DC-3s. Eleven other points will be dropped if approval is granted by the CAB in the Southwestern Area Local Service Case, Six said.

Six considers a regional type of operation a natural role for Continental. He believes there will be many more mergers in the industry, but sees no advantage in such a course for Continental, preferring to see the airline "stay healthy" and meet competition "wherever it may be."

Six also has no interest in expanding the airline's routes beyond Chicago to cover the East Coast, which he feels already suffers from over competition. But he is strongly optimistic that the CAB may grant Continental entry into Hawaii under deferred portions of the Transpacific Case, reopened by the CAB. A strong supporter of coach fares, Six hopes to offer a new, low cost fare of 3.5 cents a mile for high-density coach seating on nonstop flights to Honolulu from Chicago, Denver, Kansas City, Los Angeles and San Francisco.

Continental has been competing with American, TWA and United in the heavily traveled Chicago-Los Angeles market area for more than five years, on a daily schedule which recently stood at a total of 17 nonstop flights daily in each direction, for all carriers. Six is quick to credit Continental's Golden Jet service, with a rapid turnaround of less than 45 min., club coach flights and simplified in-flight ticketing procedures for capturing 19.2% of this market on a daily schedule of only three trips. With a strong identity at its Denver headquarters and in Los Angeles, where it has a hostess training school and jet maintenance base, the airline has won more than 50% of the Los Angeles-Denver traffic in competition with United, Six said.

Continental has no firm plans to acquire any other equipment beyond the Boeing 720B order but has been inspecting plans for several short- and medium-range turbojets, including the British Aircraft Corp. BAC-111, under its program of long-range planning. Studies are still being carried out on the feasibility of purchasing supersonic transports, Six said. Cost analyses indicate an 80-passenger supersonic transport could be operated as economically on a seat mile basis as the airline's present Boeing 707s. Emphasizing the importance of retaining Continental's financial solvency, Six said that only carriers with a strong profit record will be able to raise the necessary purchase price of supersonic airliners.

One of the major reasons for the poor financial showings made by many trunk carriers last year, according to Six, is the huge sums tied up in piston aircraft, with operational costs which have weakened year-end earnings records. With a valuation of only $7.6 million in such aircraft, compared with $66 million and $98 million for other major trunks, Continental has accelerated its write off on DC-7 equipment, and reduced the inventory of spare parts. An inventory investment for DC-7 parts was reduced from $750,000 one year ago to the current $500,000, and one DC-7 has been dropped to a residual value of only $350,000.

Attaining the airline's low breakeven load factors has required a heavy concentration on keeping daily costs in line with detailed budget projections, under 11 vice presidents, each of whom receives an accurate, daily accounting of each department. Average age of these top executives, who have a maximum of responsibility with a minimum of staff aid, is 45 and four are under 40, Six said.

Harding Lawrence credits the company's daily system of "check and cross check" for the high degree of accuracy which it has had with its budget projections, which are made for 1-, 5- and 10-yr. periods. For the first six-month period of this year, he said, Continental's actual expenses were 1.0% less than estimated under its 5-yr. projection, while revenues were 1.47% higher.

Budget Reviews

Since the first of this year the company has been using an IBM tabulation system to provide a complete budget review each month for all departments. Each department is given a code number which is applied to every item of expense. Monthly tabulations cover such items as personnel, budget projection for the period, actual expenditures and the amount of variance from the projection.

In a similar manner, the coding is used in a detailed job cost system for various phases of maintenance. Departments which find they have exceeded the budget projections are not necessarily forced to cut back expenses, Lawrence said, but use the tabulations as a unit of measure to bring their expenses in line with other divisions and with the airline's over-all cost reduction plan.

Other measures that have contributed to Continental's low breakeven load factors, Lawrence said, are the use of outside consultants as a means of keeping indirect overhead costs low; fast turnaround and en route stop servicing by ground crews, and "cockpit discipline"—a term coined by President Six to describe flying by the book to get the maximum efficiency from the aircraft.

Well in advance of delivery of Continental's first Boeing 707, special ground crews were thoroughly trained in rapid ground handling techniques for the planned Golden Jet service on a mockup of the turbojet. Indicative of the value of this advance training and the spirit of competition among ground handlers is the fact that Golden Jet turn-arounds are often completed in as little as 30 min. although they are scheduled for 45 min. On a recent Golden Jet flight, which departed 67 min. late from Houston, the lost time was recovered, primarily by ground crews at three en route stops, and the flight arrived 6 min. ahead of schedule at Los Angeles, Lawrence said.

Financially, the airline took several steps to improve its cash position and debt-equity ratio in preparation for completing financing of $27.5 million needed to purchase the four Boeing 720Bs.

Alexander Damm, vice president-finance, said Continental's equity base was nearly tripled by the conversion into common stock of major portions of convertible subordinated debentures, totaling more than $16 million. Issued during 1955 and 1958 to cover part of the cost of DC-7 and Boeing 707 purchases, more than $8 million have been converted, permitting the airline to retire $6 million in outstanding debts and eliminate debt interest costs of $350,000 a year. The balance of these debentures will be retired in the near future, Damm said.

Long-Term Loans

Last September the airline refinanced much of its debt under a series of long-term loans totaling $42 million—$25.5 million of which was supplied by 22 banks and the balance from insurance companies and other sources. A portion was acquired from the Ford Foundation, the first such airline investment made by the foundation. Part of the money was used to acquire the fifth 707 and to strengthen the airline's working capital position, which reached $6.5 million by the end of the year as compared with only $3.2 million for the previous year. By the end of this July, Damm said, Continental's cash position was calculated at $9.6 million.

Retirement of the debenture issues plus the payment of about $3.6 million on debt installments, has reduced the airline's debt-equity ratio to only 1.09, as compared with an industry average of 1.73. Terms of last year's refinancing loan, plus an additional loan arrangement of $20.5 million for the Boeing 720Bs, stipulate that Continental must not exceed a debt-equity ratio ceiling of 1.33.

Damm estimates that the airline will further reduce its debt position to a debt-equity ratio of about 0.97 by the end of this year. None of the loan agreement for the turbofan equipment will be exercised before this point is reached, and the ratio of 1.33 will not be exceeded, Damm said. First sums to be borrowed from the new loan, arranged through a majority of the same sources that provided the refinancing, probably will be borrowed for the purchase of spare engines next March, he added.

CONTINENTAL AIR

CONTINENTAL'S mechanics check 707s as part of continuous maintenance program.

While driving costs down, Continental also has been increasing the quality of its service, according to Marvin Davis, vice president-sales. Passenger revenues alone totaled $56.7 million last year for a heavy 32.5% gain over the previous year. Davis attributes most of this to an extensive advertising program emphasizing the airline's Golden Jet service, DC-7 club coach flights and other innovations such as in-flight ticketing and special reduced coach fares.

Advertising and publicity costs for the carrier totaled $2.5 million last year and for some time amounted to more than twice the industry's average advertising cost-to-revenues ratio, Davis said. With Continental's service now firmly identified in its markets, this cost is slowly dropping. It now stands at about one and three-quarters of the industry ratio, he said.

In-flight ticketing, started in 1959 on two flights, has been extended to 16 daily turbojet flights. Davis said public reaction to the lack of ticketing confusion and congestion has played a major role in increasing over-all sales. Passengers make a reservation, check their baggage in less than 45 sec., give their names to a gate agent and board the flight. Tickets are purchased on board, directly from a director of passenger service who is a supervisory employe of more than five years' experience. If no reservation has been made but there is space available, the passenger still may board and purchase his ticket in-flight, Davis said.

While the airline has been promoting the excellence of its Golden Jet service, it has also made every effort to give its coach flight passengers a service comparable to first-class service. As an example Davis cites the carrier's DC-7 club coach service which provides lower fares along with reserved seat space and complimentary meals.

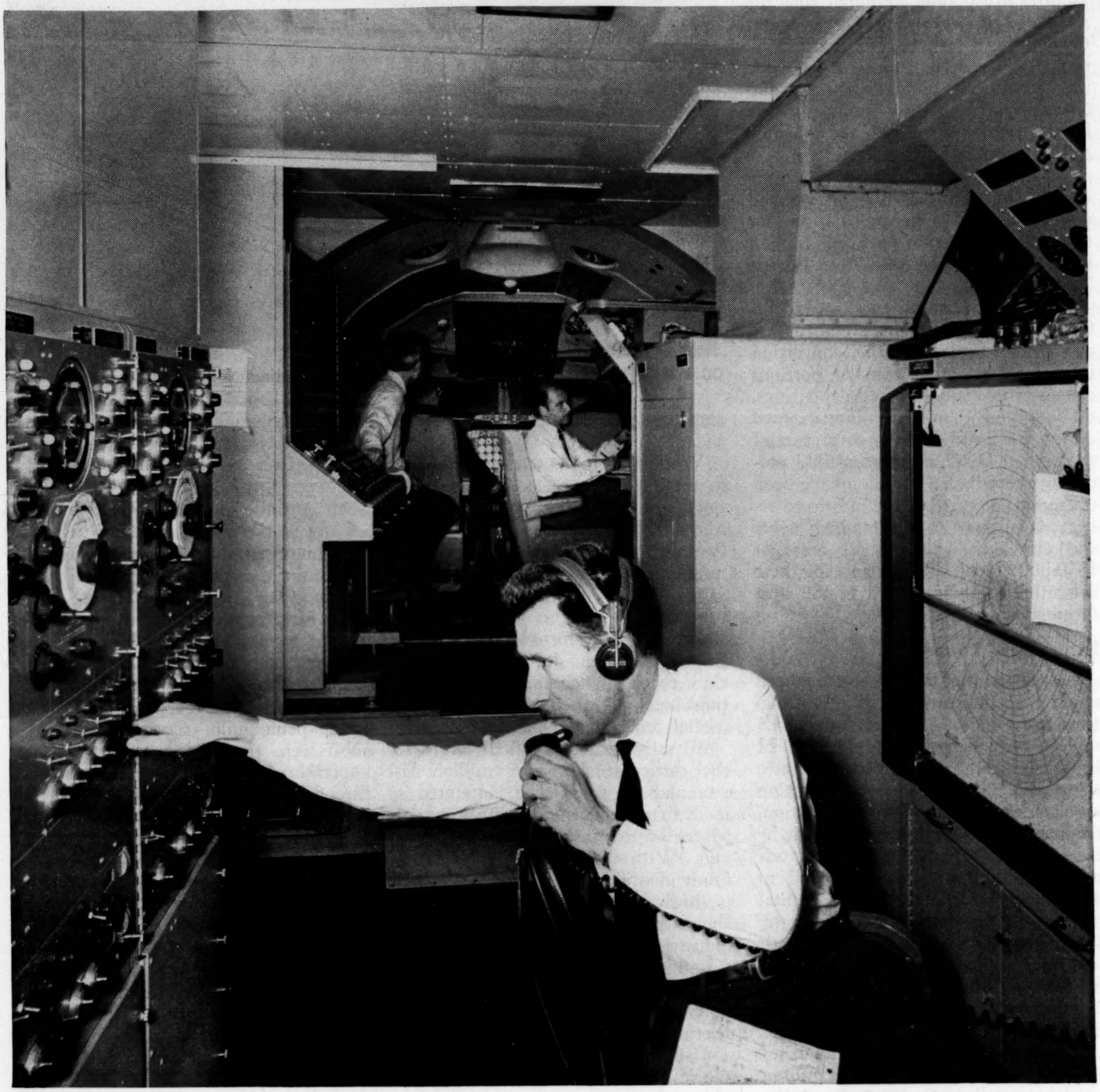
In line with this policy, Continental now is charging a new jet night coach fare that is 17% lower than previous coach fares on its Golden Jet flights between Los Angeles, Phoenix, El Paso, San Antonio and Houston. Passengers flying in the aircraft's club coach compartment pay the night coach rate while those in the first-class section pay the existing day coach fares.

A major reason for Continental's ability to maintain the low breakeven load factor has been its 707 revenue plane mile costs, which were the lowest in the industry last year at $1.53 per revenue plane mile. Costs per seat mile also were the lowest among the 707 operators at $1.33. Figures for the first six months of this year set the 707 revenue plane mile costs at $1.48 and seat mile cost at $1.29.

Charles H. Calhoun, vice president-engineering and maintenance, credits the company's advance planning with Boeing and the use of a continuous maintenance program for most of this accomplishment.

Basic guideline for this maintenance system, conducted at the Los Angeles jet overhaul base, is to avoid keeping any of the 707s out of service for more than 15 hr. and to allocate maintenance projects on a maximum time work schedule of no more than 8 hr., Calhoun said. The turbojets are scheduled so that they will return to Los Angeles for nighttime completion of maintenance and overhaul.

The Boeings are now hitting this maintenance program at the rate of about one every five days, with an average down time of 11 hr. The high time aircraft now has 8,850 hr., and four of the turbojets have completed their 8,000 hr. check during which engine pylons were removed for rebushing. Basic overhaul time on the Pratt & Whitney JT3 engines has been extended to 2,000 hr., but engines were removed in advance of the previous time limitation of 1,000 hr. for modification of the air seals on the flame tubes, Calhoun said. Guide vane in the 15th stage compressor of



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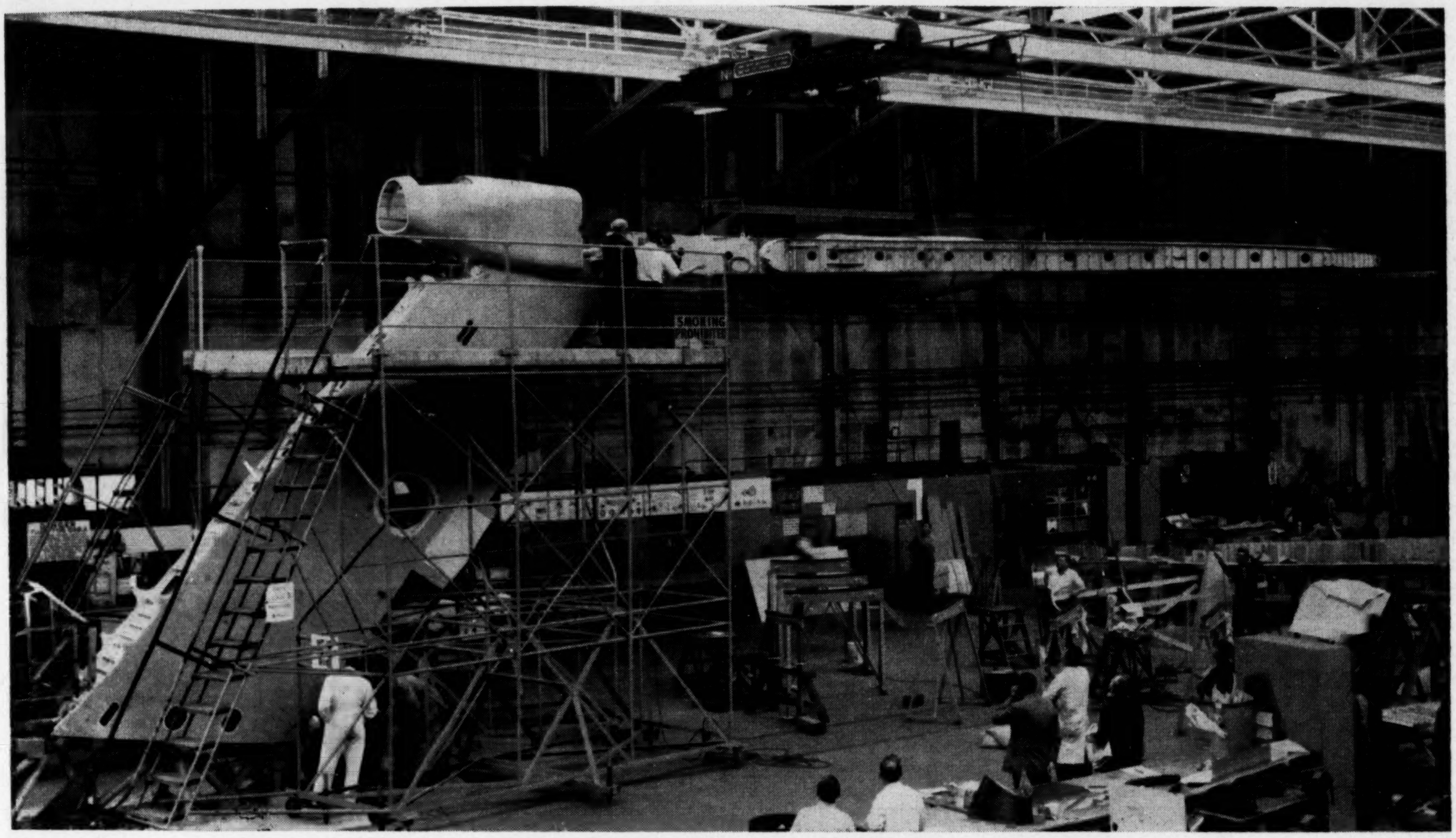

First Vickers VC.10 Tailplane Gets Functional Tests

Tailplane of the first Vickers VC.10 turbojet transport is lifted into position for functional tests at the Hurn, England plant of Vickers-Armstrongs (Aircraft). Tailplane, which has a 44-ft. span, will move later to the main assembly line at Weybridge for mating with the first aircraft. Elevator unit is split in four independent sections activated by an electro-hydraulic unit. Vickers says if one control unit should malfunction to full deflection, the three remaining sections can control the airplane until the faulty unit is switched out. The British-built transport can be controlled with a single unit only, according to company sources.

the engines has also been changed on all but nine engines on the Boeings.

Continental presently is also replacing the fore and aft carbon bearings on the engines and expects to complete this work before the 1,600-hr. mark is reached on the powerplants.

Maintenance on the Boeing fleet has been reduced and speed of the aircraft increased an estimated eight knots by replacing the old 22-tube noise suppressors with a more economical nine-tube design, Calhoun said. Plans are still in progress to lengthen the Boeings' vertical stabilizers by 30 in.

No major changes are planned to integrate the Boeing 720Bs into the maintenance program, said Calhoun, except to set up a combined spare engine and accessory inventory system for both the JT3 engines and the JT3D-1 turbofan engines.

Airframe Overhaul

Airframe overhaul on all aircraft is conducted at Los Angeles. Engine overhaul on the Viscount fleet, and for Rolls-Royce Dart powered aircraft of several small airlines, is conducted at the Denver base. Overhaul of the Boeing engines has been contracted for the past several months to the Pacific Airmotive Corp., in Burbank, California. Grand Central Aircraft, of Glendale, Calif., has been handling the DC-7 powerplant overhaul work.

A $1-million expansion of the Los Angeles jet maintenance base is planned for completion by next March and will permit maintenance crews to work on three Boeings simultaneously. Present maximum at the Los Angeles base is two aircraft.

Pilot transition to the new turbojets was accomplished in from 16 to 35 hr. training, and was aided by the company's experience with Viscount aircraft, according to Don Wilson, vice president-flight. On the basis of military experience with turbojets and Boeing test flights, Wilson said the airline determined that flight crews would have to adhere to strict "cockpit discipline" as both a safety and an economy measure, dictated by the turbojets' different and "unforgiving" flight characteristics.

Supervisory pilots took the first transition training, perfecting flight procedures which they later taught to regular line pilots.

Correcting the flight habits which pilots had developed in piston equipment was the major problem, requiring unceasing insistence on nose-high takeoffs and landings, with a touchdown at least 1,000 ft. down the runway, Wilson said.

Crews are continually observed to assure that they follow these standard procedures and failures to do so are considered sufficient grounds for a check ride, he said.

Operational economy is further improved by other "cockpit discipline" procedures calling for the early use of reverse thrust on touchdown, selection of the shortest possible air routes and the use of the first high-speed turnoffs on runways. The latter practice alone often shaves five minutes from an aircraft's scheduled arrival time, Wilson added.

Cargo Revenues

Continental's cargo revenues, up 70% during the first six months of this year over the same period last year, are playing a more significant role in the company's profit picture. Cargo revenues last year, in turn, were 95% above those of 1959.

New tariffs for such special commodities as flowers, joint bills of lading for off-route pickups and different rates designed to provide "top-off" loading have contributed to this rise. Probably the largest increase has resulted from a daytime turbojet cargo service inaugurated by Continental last February. Shipping costs were reduced as much as 39% for flights between Chicago and Los Angeles. Cargo revenues on the two daily round trips have increased 21% and 28% since the new service began, the airline said.

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Newark Airport Noise Report

These comparisons were made from data gathered by Howard C. Hardy & Associates and presented in reports to New Jersey Gov. Robert B. Meyner concerning relative noise levels of various types of aircraft arriving and departing Newark Airport:

Aircraft type	Distance from Receiving Instrument (in feet)	Maximum PNdb.* Recorded
Landing at Newark (Runway 22)		
Electra	700	96
DC-7	800	99
Caravelle	1,000	101
Caravelle	700	109
Viscount	900	102
Takeoff from Newark (Runway 22)		
Convair 440	2,800	91
DC-6	1,500	101
Caravelle	2,700	97
Caravelle	4,000	94
Constellation	6,100	100
Takeoff from Idlewild		
DC-8	2,500	104
707-120	600	123
720B	2,200	104

* Perceived noise decibels

Jet, Piston Noise Reported Equal

Short- and medium-range turbojet aircraft operating in and out of Newark Airport should create little or no noise above levels presently generated by piston-engine aircraft, independent reports released last week by New Jersey Gov. Robert B. Meyner indicated.

The primary report was made by Cornell Aeronautical Laboratory, Buffalo, N. Y., at the request of Gov. Meyner and at no charge. A supplementary report on acoustical levels was made by Howard C. Hardy & Associates of Chicago. Data obtained by the firm also was incorporated into the Cornell report.

While admitting there is no agreement on a standard measure of noise, nor on the boundary between tolerable and intolerable noise levels, Cornell used as a dividing point the 112 perceived noise decibel (PNdb.) level established by the Port of New York Authority as its maximum allowable jet noise level. This noise level is approximately equal to a trumpet auto horn, an automatic punch press in operation or the noise level in a jet engine test control room. It is slightly below the noise level generated by a multiple sandblast unit in operation.

The PNYA says that approximately 6% of all jet takeoffs at Idlewild Airport exceed this level. The PNYA does not monitor landing noises.

Tests indicated, the Cornell report said, that takeoff of short- and medium-range aircraft from Newark Airport would produce noise levels in surrounding communities similar to or perhaps somewhat less than the noise level generated by a DC-7 taking off, provided that the jets made appropriate power reductions and steep gradient climbouts.

On the other hand, the report continued, jet noise reaching the ground during landing will exceed the noise now generated by landing DC-7s.

Night Ban Proposed

Takeoff noises of jets may occasionally exceed the PNYA maximum in communities which lie under the traffic pattern for Runway 29, the report stated. The PNYA, in requesting Gov. Meyner to open the field to limited jet operations, has proposd a night ban on takeoffs from Runway 29.

The report said that, with proper precautions, noise of jet engine runups at night should not create a disturbance, but noted that no plan had been found to provide proper precautions and controls on these operations.

Pan American Loss

Pan American World Airways last week announced a net loss of $2.5 million for the first six months of 1961 compared with net earnings of $2.3 million in the corresponding period last year. For the second quarter, net income was $3.7 million after taxes, compared with a net profit of $4.4 million in the same period last year.

Three Carriers Ask Youth Fares Probe

Washington—Opposition to youth fares proposed earlier this month by American Airlines and adopted by nine other trunklines has prompted three U. S. carriers to ask Civil Aeronautics Board to suspend and investigate the promotional tariff.

Eastern Air Lines, Mohawk Airlines and Braniff Airways have objected to the youth fare plan which would allow passengers between the ages of 12 and 22 to travel at half the first-class fare (AW Aug. 7, p. 37). To be eligible for the youth discount, a young passenger could not make reservations for space prior to 3 hr. before flight time, but he could board aircraft on a standby basis.

Eastern—which as of late last week was the only trunkline that had not filed for the youth fares—contends the tariff as proposed by American is based on faulty information concerning the number of passengers between the ages of 12 and 22 using American facilities. American estimates that 3% of its present passengers are in this age group. Eastern says a survey of its "airbus" and "air shuttle" services—offering fare discounts of up to 50.1% and 27.3% respectively to all passengers—showed that 9.1% of airbus and 15.7% of air shuttle passengers carried were between 12 and 24. Eastern said that in spite of the greater reduction in fares for airbus, a higher percentage of young passengers used the more expensive air shuttle—indicating a lack of correlation between low fares and the stimulation of youth travel.

Braniff, which has adopted the youth fare as a defensive measure, contends that there is little prospect of stimulating "the more than 100% traffic increase required to offset the revenue loss and additional cost of passenger handling. . . ."

Mohawk complained that "travelwise" college youths and servicemen would be able to defeat the airlines' attempts to sell unused capacity by making full fare reservations under fictitious names hours or days in advance. Then, as departure time nears, a youth could board as a standby. When the fictitious passenger failed to appear, becoming a "no show," the youth would get his seat.

The "no show" problem could be worse in cities served by two or more airlines offering youth fares. In this case, a youth could make fictitious reservations on several airlines days before departure. Just before flight time, he could get on the standby lists. Then, when the phony reservations become "no shows," he would be assured of space on at least one of the airlines.

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Eastern Evaluating Shuttle's Economics

By Glenn Garrison

New York—Eastern Air Lines "air shuttle" is tapping a new market among travelers who formerly used ground transportation, and also is diverting a portion of the business commuter-type travel in the high density market. Intense industry interest has been aroused by the New York-Boston, New York-Washington, no reservation reduced-fare service (AW May 8, p. 40).

However, a big question is whether the shuttle can justify itself economically. The Lockheed Super Constellation equipment tied up in the service is depreciated and would otherwise be surplus, but there are other costs of operation, not the least of which is crew expenses. The service involves a scheduled airplane and crew plus a backup airplane and crew for every departure. On Aug. 1, the frequency between New York and Boston was increased to an hourly basis; between New York and Washington, schedules remain at every other hour.

Eastern is not publicizing its shuttle operation statistics, but President Malcolm MacIntyre told Aviation Week the operation is now approximately breaking even. Load factor over-all in June, he said, was better than 50%. Breakeven load factor is said to be about 50%.

The airline definitely plans to renew the experiment next October when the initial period would end, MacIntyre said. The only question in renewing will be whether on an hourly basis or cut back to every two hours between New York and Boston. Experience with the hourly service will decide that question.

Heavy Competition

Eastern's shuttle service is operating against heavy competition in the big New York-Boston and New York-Washington commuter market. Northeast Airlines offers hourly service, flying mostly Vickers Viscount turboprops, with some DC-6B and some Convair 880 jet schedules sandwiched in. American Airlines also flies hourly schedules, and last week added schedules between 3 p. m. and 6 p. m. to provide service every half hour during those peak periods. American's equipment in the market now is almost entirely Lockheed Electras, which are dual configuration aircraft.

American took an opposite view from Eastern in the market by putting in premium "Captain's De Luxe" flights featuring a drink and other services at an extra charge of two dollars. These flights first operated about noon and in the late afternoon; the noon flights have been discontinued—they proved unpopular at that time of day—but the afternoon de luxe flights, American says, are doing very well.

Northeast says its business in the market has not suffered since Eastern began its shuttle; Northeast's traffic in the commuter market is up 10% over last year, the airline said, and load factors are up too. Northeast's view is that the Eastern service is appealing primarily to the non-business type of traveler.

American, however, believes the shuttle is diluting the existing market rather than opening up a significant new market. American questions the value of the service from an industry standpoint: If it is financially unsound, the cost of the product may not be covered by the revenue it brings in and it only hurts all the airlines.

Eastern ran two surveys, each of a week's duration, of its shuttle passengers and found that the service is diverting some ground travelers but also getting a good deal of business customers.

Survey Comments

The surveys showed that passengers as far away as the West Coast heard about the shuttle through various sources, including newspapers and even through recommendations of ticket agents of connecting airlines.

Comments of the survey respondents, according to MacIntyre, were almost entirely favorable. There were some complaints about non-acceptance of checks or air travel cards for inflight payment of the fare, but these methods of payments are now accepted on the shuttle aircraft.

However, almost half of the passengers pay in flight with cash. Eastern recently installed specially designed metal carts, containing cash drawers and materials for making the inflight transactions.

Businessmen appear to favor the shuttle, according to the survey. Convenience of the service, rather than the fare, has been the chief attraction. MacIntyre said several concerns have instructed their people to use the shuttle when traveling between the points it serves.

Aviation Week spot-checked some shuttle passengers and found the reaction favorable, with convenience the chief point stressed. Example: a businessman traveling from New York to Boston, who normally used first-class air service but was trying the shuttle on the recommendation of friends, also business commuters, who had used it. The businessman liked it and planned to continue using it: he appreciated the convenience of simply coming out to the airport and getting aboard, without the bother of a reservation but with assurance of a seat.

Efforts to publicize the shuttle were not hampered by the use of a backup airplane on the first day of service to transport one passenger, who was the 96th to arrive for a flight and so could not be accommodated on the 95-passenger regular flight.

Public Acceptance

MacIntyre said the shuttle has been successful in terms of public acceptance earlier than had been anticipated. It had been felt that putting across the idea of the service would take considerably longer.

The Eastern official said the new hourly service may show a lower breakeven point than the less frequent service.

No additional ground personnel are required, and fewer backup sections are needed: on some peak flights, three sections have been needed and the backup crew problem is severe. The additional schedules may smooth out these peaks to some extent.

An Eastern survey of its "airbus" passengers—this is another type of reduced fare service offered to Florida from Cleveland, St. Louis and Pittsburgh—showed that almost 40% of the passengers had been diverted from ground transportation.

The shuttle service percentage is less than that, MacIntyre said, but is "substantial," the surveys showed. He believes the percentage of business diverted from ground transportation will increase greatly in the future, but a good percentage of the shuttle traffic always will be composed of business travelers. Eastern plans to press for sightseeing and vacation groups in an effort to expand the market. School children visiting Washington from New York and scout groups are examples of this type of potential business.

The shuttle service has diverted some of Eastern's own Idlewild-Boston first-class traffic, MacIntyre said (all shuttle flights serve La Guardia), but not very much.

Since regularity of service is a major selling point in the shuttle service, Eastern has been making every effort to achieve top on-time performance with the operation. From the beginning Apr. 30 through Aug. 9, on-time departure record for the shuttle was 95.5%, and departures not more than 15 min. late were 98.2% of the total. These figures apply to scheduled depar-

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tures only, and not to extra sections.

The shuttle service, which currently involves 12 aircraft and 35 crews, is treated as a separate operation in many respects. For example, dispatching is handled separately from Eastern's other services. A central dispatcher at Idlewild is linked directly to La Guardia, Boston and Washington. When the aircraft require major maintenance, they are routed to and from Eastern's Miami base as night coaches.

Another strong point of the shuttle service is baggage handling, which gets a great deal of emphasis. Customers deposit their bags on carts at the gates on departure, without checking or tagging them. Every effort is made on arrival to get the bags to self claim counters before the passengers arrive.

Claims for lost and damaged bags in the shuttle run ⅒ the relative volume of claims for the airline's over-all operation.

As part of the effort to make departures perform as much like clockwork as possible, starboard engines are started shortly before departure time. Last minute passengers board while the two engines are turning over.

Perishables Rotting At Moscow Airport

Moscow—Russia is having trouble moving airborne perishables to market efficiently through prescribed channels.

Aeroflot cargo personnel here have complained that large quantities of fruit and vegetables flown into the Soviet capital from southern areas of the USSR are spoiling at Vnukovo Airport because they are not picked up promptly by state-run trade organizations to which they are consigned.

The airline workers noted that fruit is frequently flown from the Caucasus to Moscow in less time than it takes to move from Vnukovo to the city's stores.

"When we complained to the chief of the Moscow City Fruit and Vegetable Administration, he replied that he wasn't aware of the problem and, besides, he had many other things on his mind.

"A telegram to the Minister of Trade of the Russian Republic wasn't even answered," the Aeroflot workers declared.

Meanwhile, an Aeroflot passenger has protested that private individuals engaged in flying perishables from Baku across the Caspian Sea to Krasnovodsk are conducting such a thriving business that travelers can't board their planes until sacks of onions and cabbages are unloaded from the cabin. He said that the speculators have their business so well organized that Aeroflot's own trucks rush the illegal, privately-owned perishables from the aircraft to market.

New Bonanza Fares Boost Traffic; Special Group, Flat Rates Proposed

By Russell Hawkes

Los Angeles—Bonanza Air Lines officials report that excursion fares begun since April have produced an upturn in traffic volume and profits and more radical promotional tariffs will soon be adopted by the line.

Bonanza expects to introduce an area fare plan this fall which will offer passengers originating east of the Mississippi unlimited travel over Bonanza's routes at a flat rate of $90 for 15 days or $160 for 30 days and also has commenced selling youth fare plan reduced tickets.

After three months of experience with excursion fares, Bonanza reported these results:

- **Total originating traffic** for April-June 1961 was up 20.3% over the same period last year. The single month of June was 25% better than the preceding June.
- **Traffic in the markets** being offered excursion fares was up 121% over the same quarter last year. June alone showed a 132% increase.
- **Bonanza offered a resort** excursion plan and a commercial excursion plan. The resort excursion plan produced the biggest effect in the markets offered it —169% for the second quarter and 200% for the month of June. Traffic between commercial excursion points was up 68% for the quarter and about the same for its final month.
- **In markets not having** the excursion fares, traffic was up 11% for the second quarter. This is considerably better than the experience of local service carriers generally for that period. Bonanza's regular fare traffic increase in the excursion markets was nearly three times as great as the increase in non-excursion markets. One of the chief doubts expressed about promotional tariffs has been that they may divert traffic which would otherwise move at regular fares. Bonanza officials say these first records remove such doubts. About 42% of the traffic in excursion markets paid excursion fares.

Under Bonanza's Civil Aeronautics Board-approved youth fare plan, persons between the ages of 12 and 22 can travel at half fare if they have purchased an annual youth identification card for $2. Bonanza Executive Vice President G. Robert Henry said the line expects immediate and wide use of the fare by students on summer vacations and servicemen based in the airline's trade area.

Bonanza is also planning a low "senior citizens" fare for people over 65 and special rates for groups of people over 65 and special rates for groups of people traveling together. The line has been offering reduced rates to clergymen for some time.

Bonanza President Edmund Converse said that he believes the success of the excursion plan proves that airlines had nearly priced themselves out of business by four fare increases in the past two years. Bonanza officials are convinced that the other promotional rates going into effect will prove equally productive. They say that traffic increases in the excursion markets have been made up of people who would not have traveled by air at regular rates and therefore were not subtracted from the traffic of competing lines.

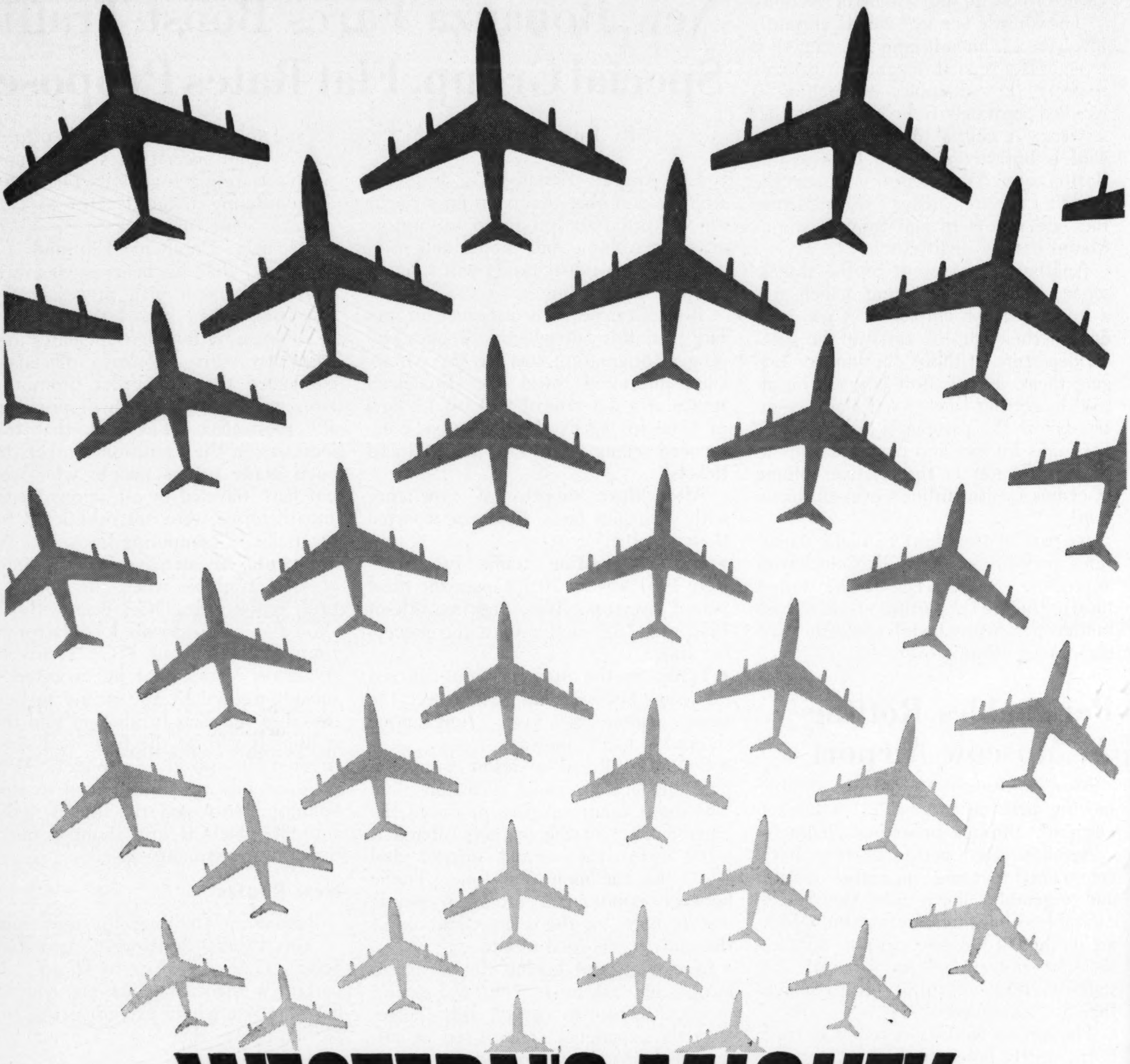
Despite an increase in the number of seats available when the airline entirely replaced its DC-3 fleet with Fairchild F-27s, Bonanza's load factor rose from 42% to about 47%. Henry told Aviation Week that he expected the subsidy needed by the airline to be reduced in the near future and said there is hope it will be the first local service to drop the subsidy completely. While no dividends are being issued to stockholders, Henry said the line is making a profit which is just about a fair return on investment.

New Routes

Bonanza is bidding for new routes in the Pacific Southwest Area Local Service Case according to Henry. Important new routes which the company hopes to win would extend service from Nevada into the San Francisco Bay area.

The company would also like to have direct service between San Francisco and Los Angeles, according to Henry. Since the line is not bidding for such a route, it seems likely that it may seek a merger with a carrier already providing this service.

The boldest of Bonanza's new tariffs is the area rate plan promotionally named "Bonanzaland". Unlimited use of the line's routes for a flat rate is admittedly illegal under the Civil Aeronautics Act but Bonanza officials are confident CAB will reduce all its past precedents and grant an exemption so that such a tariff can be filed. The law gives the Board power to grant such exemptions and its present policy is highly favorable to promotional rates. The area rate plan would be introduced for one year on an experimental basis to see if it is profitable. Henry said he expects a reasonable yield from the plan but not an unusually high one.



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SHORTLINES

▶**Bonanza Air Lines'** passengers holding Diner's Club cards can use them to charge transportation on any of the airline's flights.

▶**Consol,** a long-range radio navigation aid, is being installed by Federal Aviation Agency at Miami, Fla. The $876,000 installation, to be in operation this fall, will assist navigation in the North and South Atlantic, the Caribbean, and off the U. S. East Coast.

▶**Federal Aviation Agency** is proposing an amendment to the Civil Air Regulations that would place the responsibility for keeping intoxicated persons off aircraft with airline ground personnel and cabin attendants rather than with the pilot.

▶**Lake Central Airlines** reports a net profit of $72,448 for the first six months of 1961 compared with a $73,489 net loss for the same period last year.

▶**NAHA Flying Club** members on Okinawa will no longer have to fly 100 mi. between airports to qualify for a U. S. private pilot's license, by permission of Federal Aviation Agency. Reason: The island is only 62 mi. long and its airports only 40 mi. apart.

▶**Pan American World Airways** will begin nonstop service with jet equipment between New York and Antigua, British West Indies, on Dec. 16. On Dec. 19 the flight will be extended to include service to Point-a-Pitre, Guadeloupe, French West Indies.

▶**Scandinavian Airlines System** will begin two DC-8 jet flights weekly from Copenhagen to Tokyo via Karachi, Bangkok and Manila on Sept. 28. One flight will call at Frankfurt, Zurich and Rome, the other at Dusseldorf, Zurich, Rome and Cairo. The DC-8s will replace DC-7Cs now used on these flights.

▶**Trans World Airlines** is constructing snow melting pits at New York's Idlewild Airport to eliminate the danger of piled snow damaging jet pods in the ramp area. The pits will be equipped with portable heat generators capable of melting 25 tons of snow per hour.

▶**U. S. scheduled airlines** will be grounded for 12 hr. beginning Saturday, Oct. 14, and extending into Sunday Oct. 15 during Sky Shield II a North American Air Defense Command exercise to check the North American air defense system as a whole.

AIRLINE OBSERVER

▶Najeeb Halaby, Federal Aviation Agency administrator, will serve as chairman of a steering committee named to supervise a nine-month study of international air transportation by a private consultant. Committee includes representatives from the Civil Aeronautics Board, Defense Department, Commerce and other government agencies. The study plan, an outcome of a recommendation in the Project Horizon report, has been criticized by some industry officials who feel that nine months is too short a time to cover all the complex problems facing international air transportation. As of late last week, the committee had not chosen a consultant firm to handle the job.

▶**Domestic trunkline traffic continued to decline in July while available seat miles again rose to pull the industry's monthly load factor to one of the lowest levels in recent years. Passenger revenue miles for the month dropped 1% to 2.66 billion. The industry has registered passenger revenue miles gains in only two of the past nine months. Available seat miles climbed 10% during the month to reach a record high of 4.76 billion. Load factor, which has dropped steadily virtually every month since turbojet equipment came into service in substantial numbers, fell 6.16 percentage points to 55.79%. Industry load factor has moved above the 60% mark in only one month of the last 10.**

▶Radar bright display and scan conversion system will be installed at Idlewild, Newark and La Guardia airports by Intercontinental Electronics Corp. to provide pilots with radar weather information. System will display cloud formations and general weather conditions up to 250 mi. from the New York airports.

▶**Watch for TWA to show serious interest in the General Electric CJ-805-23 aft-fan engine for its prospective Caravelle order. Since the order has been deferred (AW Aug. 14, p. 42), the GE engine becomes competitive on a time basis.**

▶Eastern Air Lines will introduce service innovations within the next few months designed to improve scheduling and generate a higher volume of first-class traffic.

▶**Air Transport Assn. and the National Aeronautic Assn. have developed a program which will enable U. S. airlines to register speed records set on regularly scheduled flights with the Federation Aeronautique Internationale. At the present time, there are no official speed records of U. S. airlines registered with FAI, although five foreign flag carriers have approved records on file, including Qantas Empire Airways with the speed record between San Francisco and New York.**

▶Federal Aviation Agency is studying the potential of the helicopter as an airport fire rescue vehicle. Agency is showing interest in the Kaman H-43B Huskie for this purpose.

▶**Seat capacity of International Air Transport Assn. members rose 47% during the second quarter of 1961 over the same period last year on North Atlantic routes. Total number of passengers climbed only 4.5% in the same period resulting in a 20.6 point drop in load factors. Economy-class passengers accounted for 86% of all traffic. Of the 500,277 passengers carried on the route during the three-month period, only 72,277 flew first-class.**

▶Washington-Baltimore Helicopter Airways, an applicant with the Civil Aeronautics Board to provide scheduled helicopter service in the Washington area, now has a paid-in capitalization of $1,350,000. Contract and charter service has been started with a Bell 47H helicopter.

▶**United Air Lines first-class passengers flying between San Francisco and Los Angeles so overwhelmingly favor martinis over other drinks that the carrier has installed a spigot in a recess in the forward galley which dispenses chilled, premixed cocktails. And since most passengers ask for a second martini during the flight, two martinis are automatically served each customer.**

Cuba Returns Electra; Right to Search Asked

Washington—Eastern Air Lines' hijacked Electra was released by the Cuban government last week after an exchange of diplomatic notes and the return by the U. S. of a Cuban patrol boat attached by a U. S. firm for nonpayment of debts.

Congress, meanwhile, continued to press for legislation aimed at averting further hijack incidents, while the airlines strengthened security measures and sought Civil Aeronautics Board authority to subject suspicious passengers to personal search.

Impounded at Havana since its July 24 diversion by a Miami waiter, the four engine turboprop was reported to be in "surprisingly good condition" by a 10-man Eastern team which flew the aircraft to Miami after a thorough inspection. Very few replacement parts were needed. The Electra was started by a mobile ground unit flown to Cuba. Eastern maintenance officials said the Electra would undergo a more searching examination in Miami and probably would be returned to scheduled service by this week.

The Cuban patrol boat was released after the Harris Advertising Agency of Miami agreed to let it go "in an effort to demonstrate national unity." The agency has seized 10 Cuban aircraft and sold nine of them under a federal court order granted because of unpaid Cuban debts.

President Kennedy recently urged caution in dealing with hijacking incidents and pointed out that more than 25 Cuban aircraft have been brought to the U. S. by defectors. Fourteen of the aircraft have been returned and nine sold.

House Commerce Committee members have reported out their version of a bill on hijacking, which is expected to be presented on the House floor this week. The bill is more detailed than a version passed by the Senate, but both carry a maximum life sentence for hijacking plus provisions that could impose a death sentence if dangerous weapons were used. A joint conference may be needed to arrive at a bill acceptable to both houses.

Meanwhile, the Civil Aeronautics Board granted Eastern Air Lines, National Airlines and Mohawk Airlines permission to ask passengers to submit to a personal search in cases where the airlines suspect weapons are being carried.

Other airlines were expected to request the same authority to protect themselves against court actions that might result from the searchings.

MEA Cuts Ties

London – British Overseas Airways Corp. has agreed to sell its 49% interest in Middle East Airlines to MEA for $1.1 million and the Lebanese airline currently is making arrangements for repayment of about $8 million in loans.

Financing has been undertaken by a group of Lebanese banks. MEA has been a BOAC-associated company since 1954 and last year showed a profit. Pooling agreements between the two airlines will continue, according to Sir Matthew Slattery, BOAC chairman, and Sheikh Najib Alamuddin, MEA chairman.

TWA Completes 707 Finance Arrangement

Trans World Airlines completed agreements last week for sale of $107 million in 6% equipment mortgage sinking fund notes to institutions and $40 million in 5½% equipment mortgage notes to banks to finance purchase of 20 Boeing 707-131B and six 707-331B turbofan-powered transports.

The agreements followed closely the revelation that TWA had filed suit against Howard Hughes and Hughes Tool Co. alleging interference with the airline's effort's to complete the 707 financing (AW Aug. 14, p. 42). Chances that TWA might press for a temporary injunction to prevent such interference faded considerably with the signing.

TWA said there was no connection between the filing of the suit and the completion of the financing. Generally the same group of institutions and banks participating in TWA's earlier jet financing last winter also are participating in this one though at interest rates ½-1% lower. Dillon, Read & Co., Lazard Freres and Lehman Bros. were the investment bankers negotiating the agreements.

Grace Denies Any Plan For Panagra Merger

Washington—Current industry opinion that a merger between Panagra and Braniff Airways will be a major outcome of the forthcoming Civil Aeronautics Board investigation of South American routes (AW Aug. 14, p. 47) is being called erroneous by W. R. Grace & Co., which holds a 50% interest in Panagra.

Grace last week said it would oppose any merger and claimed that the Board order calling for the investigation did not suggest, even by implication, that the Board would seek a merger between the two companies as a means of resolving the South American route problem.

In its order, the Board said it had tentatively concluded that South America should be served by a West Coast and East Coast route from U. S. gateways, each by a single U. S. flag carrier. At the present time, three U. S. carriers—Pan American World Airways, Panagra and Braniff—provide major services to points in South America.

The Board specifically stated in its order that "powers granted the Board . . . do not include authority to compel merger, or to terminate the entire route of a carrier." However, the Board can exercise its powers over the economic stability of any carrier by strengthening the routes of one to give it a competitive advantage over the other.

The investigation was instituted to determine "whether the public convenience and necessity require that the Board should modify the certificate or certificates of all or any one of" the three carriers in order to implement the route pattern proposed for South America.

Swissair Plans 880 Far Eastern Service

Zurich—Swissair is scheduled to begin jet service to the Far East on Sept. 15 with two Convair 880 transports on lease pending the arrival of the longer-range Convair 990s on order.

Both 880s on lease from Convair were to be in Europe by late last week. Before service begins, they will be used for crew training from Scandinavian Airlines System's Arlanda Airport near Stockholm. Proximity of Kloten Airport precludes such training from Zurich.

EAL Deficit Traced To Engineers' Strike

Eastern Air Lines last week announced a net loss from operations of $6,380,000 for the first six months of 1960. Operating revenues for the period were $149 million, a 2.3% increase over the same period last year, but operating expenses climbed 3.7% to $157.9 million.

The airline said that the application of a special credit of $5.3 million after taxes, representing overhaul reserve no longer required due to the changeover to a continuous maintenance system, resulted in a net deficit charge of $1 million to earned surplus in the period. The first-half operating loss was primarily due to a loss of approximately $6 million in revenues caused by the strike of flight engineers in February together with general business conditions affecting the entire industry, Eastern said.

Eastern held its available seat miles during the period to a 1% increase while revenue passenger miles fell a slight 0.3%.

Dargue; Capt. Townsend F. Dodd flew with Carberry. As a safeguard, each of the senior officers carried duplicate dispatches.

The punitive expedition, led by Brig. Gen. John J. Pershing, had been ordered by President Wilson immediately after Villa's 485-man bandit army had pillaged the town of Columbus, N. M., 50 miles from El Paso. The First Aero Squadron at Fort Sam Houston, equipped with eight service-worn Curtiss JN-3 training planes, was sent into action in March — two months after *Villistas* had murdered 19 American passengers in a train holdup near Chihuahua City. The squadron, with Captain Foulois as commander, joined Pershing's forces at Casas Grandes to begin the first reconnaissance flights over Mexican territory. By early 1917 Jennies from the First Aero Squadron had flown 540 sorties covering 19,000 miles. In August, the squadron left for Europe to attain a notable World War I combat record.

The Curtiss Jenny was the most important training ship of the war — and the greatest Jenny of all was the JN-4D, powered by a 90-hp. Curtiss OX-5 engine cowled in sheet aluminum. It had a top speed of 75 mph. at sea level and a rate of climb that averaged about 2,000 feet in 10 minutes.

More than 4,500 Jennies were manufactured for American forces during World War I by Curtiss and seven other manufacturers. Hundreds more were produced in the United States and Canada for the English and British Empire air services.

Large government stocks of Jennies were cleared out shortly after the Armistice at auction prices as low as $50. Jennies by the hundreds appeared all over the country.

In the postwar years, the Jenny became the first plane to fly a regular airmail schedule and was the first and most readily available private plane. In the hands of skilled pilots, the Jenny earned the title "Queen of the Barnstormers."

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Self-Focusing Antenna Arrays Developed

By Barry Miller

Los Angeles—Fresh approach to antenna system design which yields a new type of antenna, called a self-focusing or adaptive antenna array, capable of quickly seeking and locking onto and then automatically tracking a signal source, was demonstrated recently in laboratory tests.

The approach may provide the very high gains, perhaps in excess of 70 db., needed for applications as receiving video signals from interplanetary space probes.

The technique involves the use of phase-lock loops, or electronic servo systems, which have been used extensively in space telemetry systems, to automatically adjust the phases on elemental antennas in an array so signal voltages picked up by each element can be added coherently while the noise is added incoherently. While conventional antenna arrays seek to accomplish the same end, they require some type of programing to compute the phase shifts introduced into each element for incoming waves at different directions and frequencies.

The unusual antenna design approach has been under study for the past two years in separate, independent efforts by two companies on opposite sides of the country. Recently, both established the feasibility of the self-focusing antenna concept in laboratory simulators. The two organizations are the Surface Armament Division of Sperry Gyroscope Co., Great Neck, N. Y., and Space-General Corp. of Glendale, Calif.

Space-General is a new corporate entity (AW July 10, p. 79) combining Aerojet's Spacecraft Division with Space Electronics Corp., which has conducted the adaptive antenna work.

Acquisition Time Factor

Acquisition times of the phase-lock loop array—that is, the time it takes to look for and lock onto a target—are superior (shorter) than those of a conventional array, according to Dr. Anthony F. Gangi of Space-General. For a signal-to-noise ratio of approximately plus 3 db., the acquisition time of the phase-lock system is no greater than 0.6 sec. compared with about 0.7 sec. for the conventional array. Because the phase-lock system is adaptive, it can acquire a source more rapidly for higher level signals, Gangi says. The conventional array, he points out, has a fixed acquisition time for signals equal to or greater than the minimum signal detectable by a conventional array. In addition, he says, the phase-lock system can acquire signals below the minimum detectable signal although it takes a longer time.

Other advantages of the phase-lock loop antenna array, cited by Gangi, are that the system is:

- **Adaptive to changes** in antenna spacing.
- **Adaptive to changes** in signal level and noise spectral density.
- **Capable of using** the incoming signal to automatically and electronically collimate the antenna array beam.

In addition there would not be any problems with aging in phase shifters or antenna elements or phase differences arising when spacing between antenna elements changes.

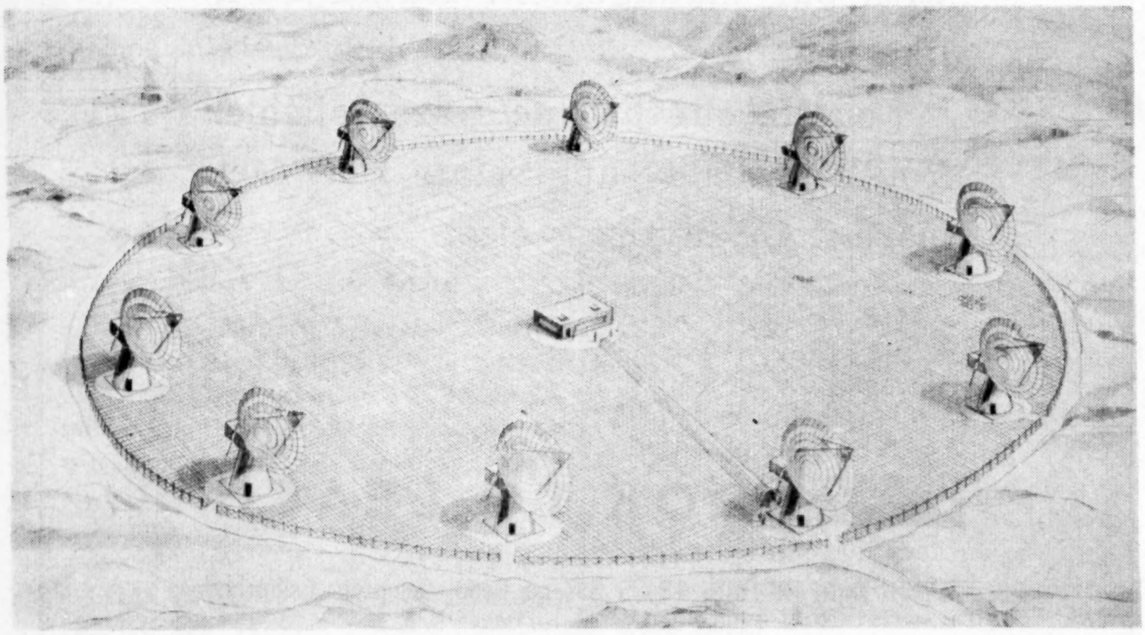
Sperry refers to its phase-lock loop array by the name Athesa (for Automatic Three-dimensional Electronic Scanned Array). Studies by this company's engineers indicate that where high-gain antennas are required the phase-lock loop technique will supply it and at considerable less cost when a gain of about 60 db. is required. Achieving gains in excess of 70 db., they say, with conventional techniques runs into difficulties—maintaining mechanical tolerances on large dishes and phase decorrelations due to atmospheric inhomogeneities. Because these are both phase errors, automatic phase control techniques as provided by the phase-lock loop approach can be used to eliminate them. A report on Athesa was presented at the recent Global Communications meeting in Chicago.

One important byproduct of the phase-lock loop approach, Space-General believes, will be a stimulus for breaking down the barrier between antenna design and transmitter/receiver design. With the gain of the antenna made possible in part electronically by the insertion of phase-lock loops between the receiver's mixer and IF strips, antenna and receiver design become interrelated. The collapse of the arbitrary division between the two technologies could well have salutary effects upon both.

Study Support

Phase-lock loop antenna studies have been supported by several government agencies. Space-General's efforts were sponsored in part by two small contracts, one from the National Aeronautics and Space Administration's Jet Propulsion Laboratory, the other from Air Force Cambridge Research Center. The former contract called for an investigation of the requirements and feasibility of an electronic, self-focusing, tracking antenna system while the latter required a laboratory simulator to demonstrate the results of the former.

Sperry's work has been supported under a continuing Air Force study from an agency the company declined to identify but which is believed to be Rome Air Development Center. The company says it believes the most promising applications for its Athesa technique are microwave power broadcasting, long-range target detection and tracking, communications with both



ARTIST'S CONCEPT of an array of parabolic antennas as part of the Athesa concept (Automatic Three-dimensional Electronic Scanned Array) which can provide high antenna gains needed for deep space communications.

High-Gain Antenna Functions

Communications over planetary distances with space vehicles which do not have unrestricted amounts of power at their disposal and whose antennas are limited in size places a heavy burden on ground receiving antennas. For receiving video information (large bandwidth) from spacecraft near Mars or Venus, antennas with high gains—in excess of 60 db.—would be desirable, according to engineers at Sperry Gyroscope Co.

Antenna gain—a measure of how well the antenna gathers radiation from a single direction over a large area and focuses it on a smaller area—can be realized in a number of ways. These include:

- Reflector antennas (parabolic dishes)—Reflector's shape makes the length of all paths from the radiating source to the receiving point or focus equal. At the focus, radiation from any portion of the dish area is in phase or coherent with radiation from other portions of the dish.
- Refractor antennas (dielectric lens)—Equivalent free space paths lengths of all paths are equalized by causing waves to travel in some portions of the path at less than the velocity of light in free space. Rays are bent or focused to a single point, or radiation over large area is brought into phase at the focus.
- Antenna arrays—an increase in effective aperture (proportional to gain) can be realized in an array—a coupled system of antennas. Arrays employ phase shifts, provided by mechanical or electronic phase shifters, that effectively are time delays. Individual signals from each elemental antenna of the array can be delayed by a precise amount and then added coherently. The array's focus is the sum junction at which shifted inputs are added.

Each antenna type has its own peculiar problems or shortcomings when employed for scan and track operation, according to Dr. Anthony Gangi of Space-General Corp. Among these he cites the relatively long time needed to acquire a radiating source, the possibility that a false indication of source direction will be given if the source is acquired on a side lobe, the high degree of mechanical precision in fabricating dishes or the need to program an antenna array with some type of computer and the relative inflexibility of the systems in operation.

Different techniques can be used to enable the system to look in different directions. Parabolic reflectors or their feed points can be moved but the inertia of moving parts required imposes limits on search times. Or the beam can be switched between a number of fixed feed points. Mounting numbers of feed points begin to interfere with incoming radiation, however, Gangi said. There are only a discrete number of directions for the beam and it must be moved in steps, he added.

Direction of the beam can be changed continuously in a dielectric lens system by moving feed point, but use of mechanical motion inhibits rapid scanning or beam switching. Many fixed feed points can be employed without blocking incoming radiation, but here again, Gangi points out, the beam can be moved only in steps and to a discrete number of directions.

Hence, reflector and dielectric lens systems are either limited in speed due to relative sluggishness of mechanical motion or in their beam directional accuracy.

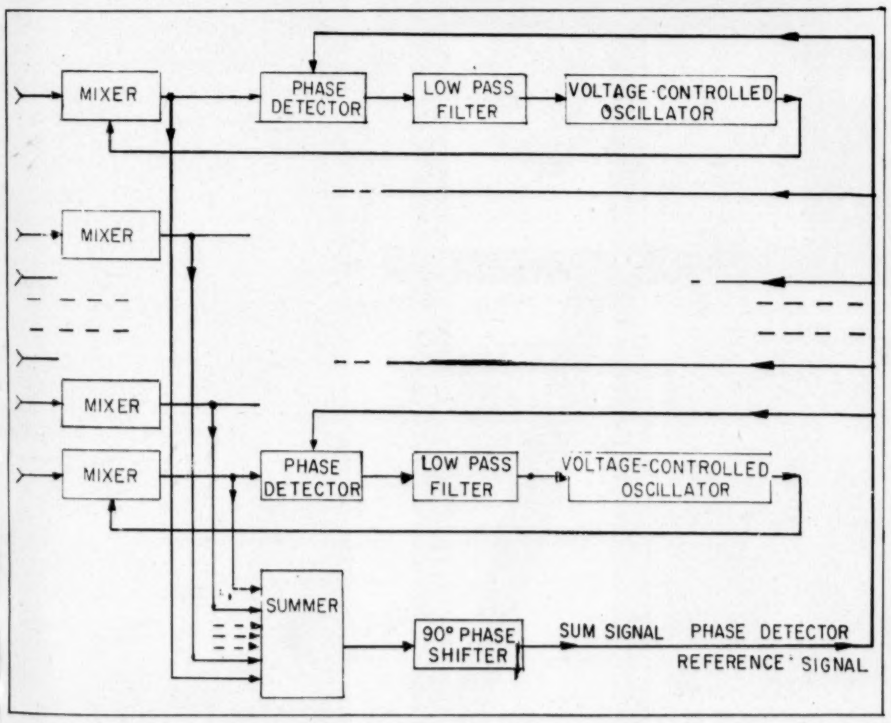
Antenna arrays rely on mechanical phase shifters, electronic phase shifters, such as ferrite shifters, phase-shifting circuits and frequency scanning. They can be made large without great precision in initial installation, Gangi says.

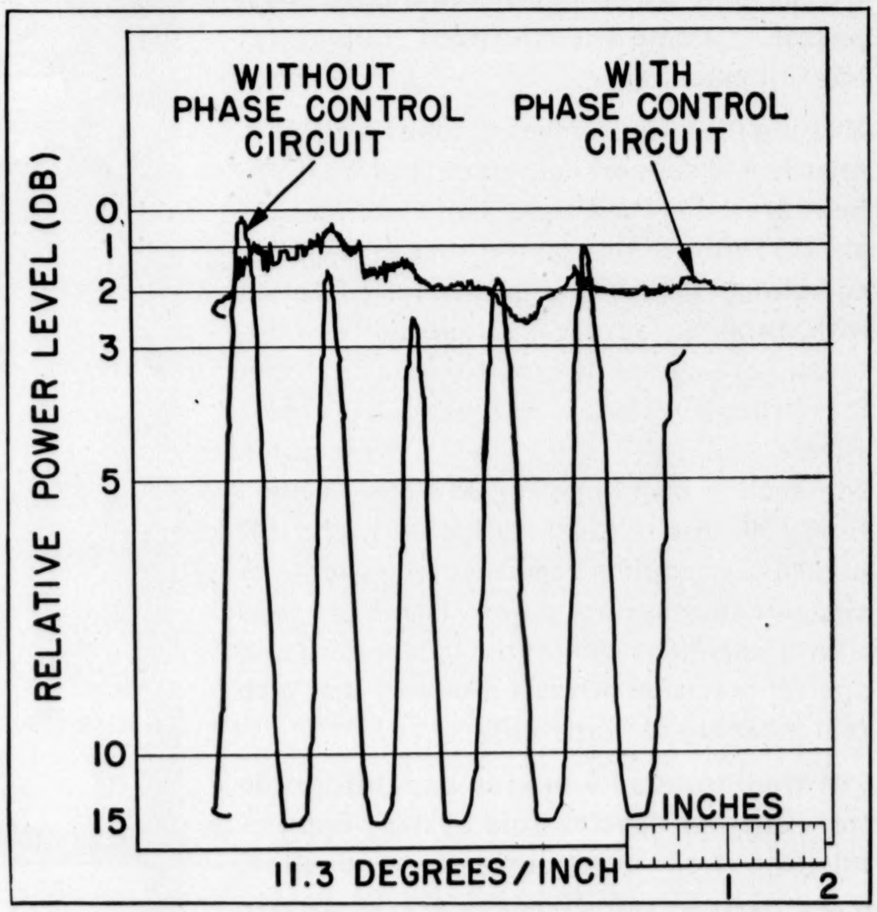
Although they have faster response, phase shifts introduced at each elemental antenna must be computed for each direction and frequency of an incoming wave. Phase shifts are a function of the spacing between antennas, so changes in spacing cause errors. Aging can introduce errors into the array elements, degrading the narrow beam.

Frequency scanning is rapid but only a particular frequency can be used in one direction—a disadvantage for communications systems. Frequency scan arrays must be constructed initially to a higher degree of precision than a phase shift array since the latter's initial errors can be compensated and they require receivers and transmitters capable of covering the wide frequency band used for scanning.

A phase-lock loop array will adjust the phase of each elemental antenna automatically, Space-General says. Changing phase shifts electronically makes rapid scanning possible.

An antenna source must be capable of locking onto a source by keeping its beam pointed in the direction of the source. The time required to look for and lock onto that source—called the acquisition time, should be short. Ability to move the beam rapidly and accurately plays an important part in acquisition time. The phase-locked array will have short acquisition times and be suited for scan and track operation, Gangi says.





BLOCK DIAGRAM of Space-General's active adaptive antenna array which is expected to be suitable for scanning and tracking (above). Patterns of two horn antennas (right) spaced 12½ in. apart obtained with and without closed loop phase control circuits in tests on C-band model at Sperry Gyroscope Co.

WEATHERHEAD FLUID POWER PRODUCTS . . . SYSTEM ENGINEERED

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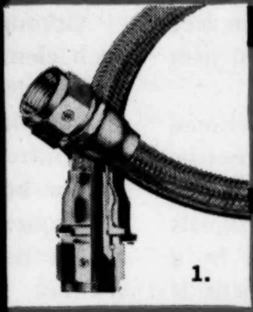
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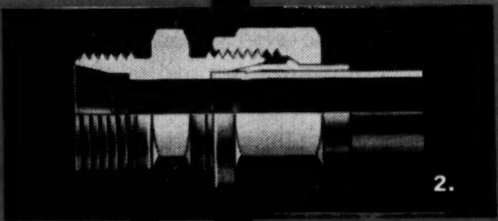
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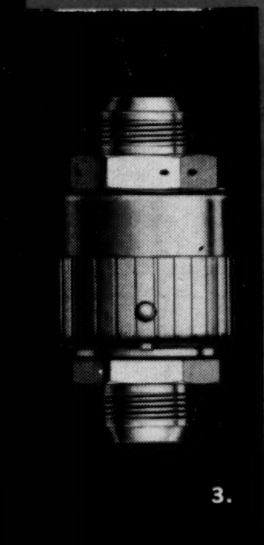
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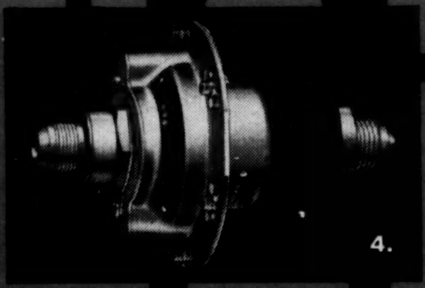
4.

It's the time when innumerable tests must pay off . . . a time when the word "reliability" has full meaning.

Meeting the critical needs of today's aircraft, missile and support equipment are Weatherhead precision fluid power components such as: (1) Teflon armor-plated hose assemblies combining the unique properties of Teflon with durable, leakproof Braid-Lok end fittings; (2) a complete range of MS (ER) flareless fittings designed to withstand the most severe applications; (3) quick disconnect, self-sealing couplings for straight-through flow with positive safety locking; and (4) breakaway couplings and regulators for missile guidance system power. These are only a few of the many Weatherhead standard and special precision aircraft products that give real meaning to "reliability".

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active and passive satellites, other forms of space communications and atmospheric research.

Operation of the self-focusing antenna can be illustrated by an accompanying block diagram (page 55) of what Space-General calls its active adaptive antenna array system. At left, incoming signals, picked up by elemental antennas in the array, are mixed with signals from voltage-controlled oscillators.

Only two of many possible channels are shown.

The voltage controlled oscillators are varied in frequency and phase by the signals from the phase detectors until the signals from the mixers are all at the same frequency and phase, the company points out.

These signals are then added in a summing network.

Voltage controlled oscillators come to an average zero voltage frequency and then assume the relative phases of the input signals. In this way, phase shifts introduced by different path lengths are adjusted automatically by these oscillators.

High-Speed System

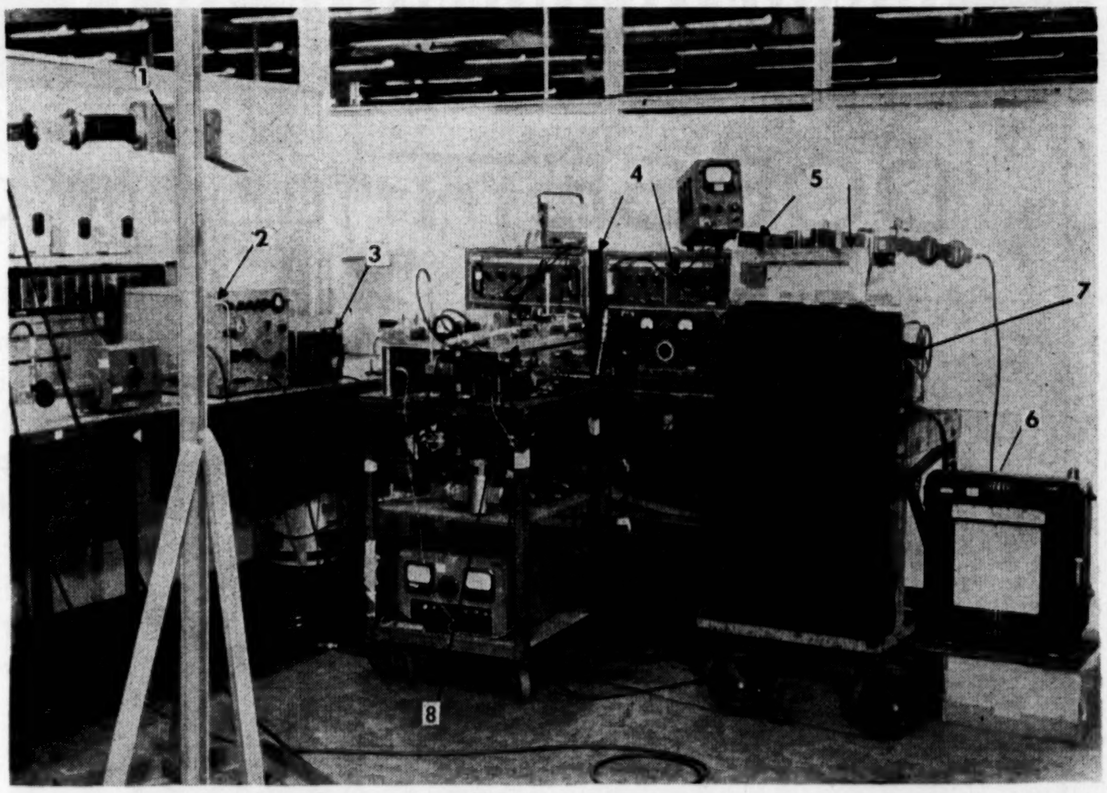
Because the system is electronic it can be made very fast. Speed of acquisition is determined primarily by system gain and the bandwidth of the low-pass filter preceding the voltage-controlled oscillator. The bandwidth of the system is governed mainly by the ratio of signal strength to noise spectral density.

According to Space-General, adjusting phases automatically by phase-lock loops means:

- **Spacing between elemental** antennas can change with time.
- **Extraneous phase shifts** introduced into elemental antennas by aging and other causes do not degrade the narrow beam.
- **Source cannot be acquired** on a side lobe.
- **Spacing between elemental** antennas need not be known accurately.
- **Phase shifts** need not be calculated as they must be in a conventional, or open loop array.
- **System changes** its bandwidth in response to the signal level, i.e., for large signal levels the bandwidth of the phase-lock loop rises, giving shorter acquisition times. Hence the system can be designed to automatically acquire signals of any level in the shortest possible time. It is this property of the system—the ability to shorten acquisition time as signal strength increases, thereby increasing bandwidth—which makes the system **adaptive.**

System can also be made adaptive to changes in noise spectral density. This is accomplished, Space-General says, with bandpass limiters at the output of the mixers. These devices can maintain the same signal-to-noise ratio in their outputs as in their inputs. They also have constant output power.

These relations enable the output signal to be effectively constant for high signal-to-noise ratios. When these ratios are low, output signal power is proportional to input signal-to-noise ratio. An increase in the noise spectral density



SELF-FOCUSING ANTENNA test model in laboratory at Sperry Gyroscope Co., Great Neck, N. Y., was employed in establishing feasibility of electronically adjusting phase differences at elemental antennas so they can be added coherently. Equipment includes: transmitting antenna (1), signal source (2), reference oscillator (3), power supplies (4), phase-locked antennas (5), chart recorder (6), RF absorbing material (7) and phase-locked loops (8). Tests were conducted at 5,650 mc. (C-band).

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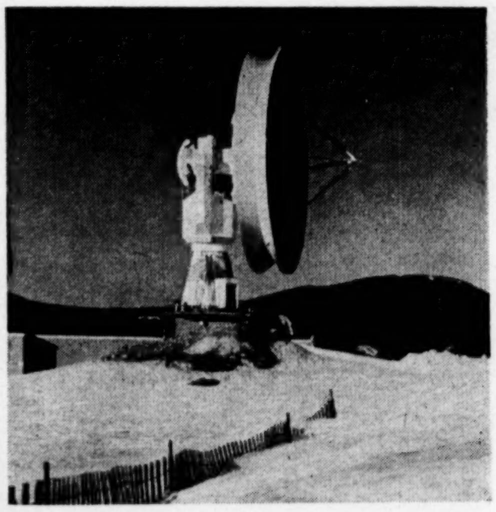
with input signal power constant will give a smaller output voltage, thus lowering the gain of the phase-lock system and in turn reducing the bandwidth of the phase-lock system. Hence, in the phase-lock loop bandwidth, a fairly constant signal-to-noise ratio will be maintained when the noise spectral density increases. This ensures, Space-General says, that the system will acquire and track the source signal. The rms phase jitter in the voltage controlled oscillators will not rise when the noise spectral density increases, the company says.

To demonstrate the feasibility of the phase-lock loop system, both companies have built laboratory breadboard units. They differ in that the Sperry model was a two-loop system operated at C-band while the Space-General model was an eight-loop unit at audio frequencies.

The Sperry model consisted of two phase-locked loops connected to open-ended waveguide radiators several wavelengths apart. A third horn was used as a target, or source. With the loops disconnected and the source horn transmitting, the open-ended horns were scanned and the IF signals in the loops were coherently added, according to the company. A grating lobe pattern resulted as the signals in the two receiver horns added in and out of phase.

Then the phase loops were connected and the gain was shown to be substantially constant over the scan angle of the array. Deviations were attributed to reflections from metallic objects in the indoor test facility.

A transmitter was next connected to the Athesa locked horns by means of an isolator and offset in frequency about 110 mc. from the received signal used to lock the phase loops. A receiver was connected to the target horn and a pattern was taken with and without the Athesa loops operating.



Lockheed Antenna

Sixty-foot diameter satellite tracking antenna at Lockheed's New Boston, N. H., facility is used in connection with company's Discoverer, Midas and Samos satellite programs for the Air Force.

Control and Instrumentation Engineers

A key research and development program is now underway at Atomics International to design long-life, compact, lightweight nuclear reactors that will provide auxiliary power systems for space applications. Many interesting problems exist to challenge electrical engineers who want to relate their present experience to reactor technology in any of the following areas:

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Electrical control system design and/or aircraft or missile flight instrumentation design. Will establish flight instrumentation requirements, block diagrams for flight and test systems, preliminary specifications for each instrument or subsystem.

TELEMETRY

Responsible engineers to analyze, plan and specify the telemetry required to ascertain the performance of nuclear power plants during space tests. The individuals must have experience in missile instrumentation and telemetry of temperature, vibration, acceleration, etc. BS or MSEE preferred.

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Dynamic and control analysis including system start-up and full power operation. BS or MSEE plus familiarity with latest analog and digital techniques required.

CIRCUIT DESIGN

Electronics engineers experienced with both vacuum tube and magnetic devices to design and develop control circuits for compact nuclear power plants.

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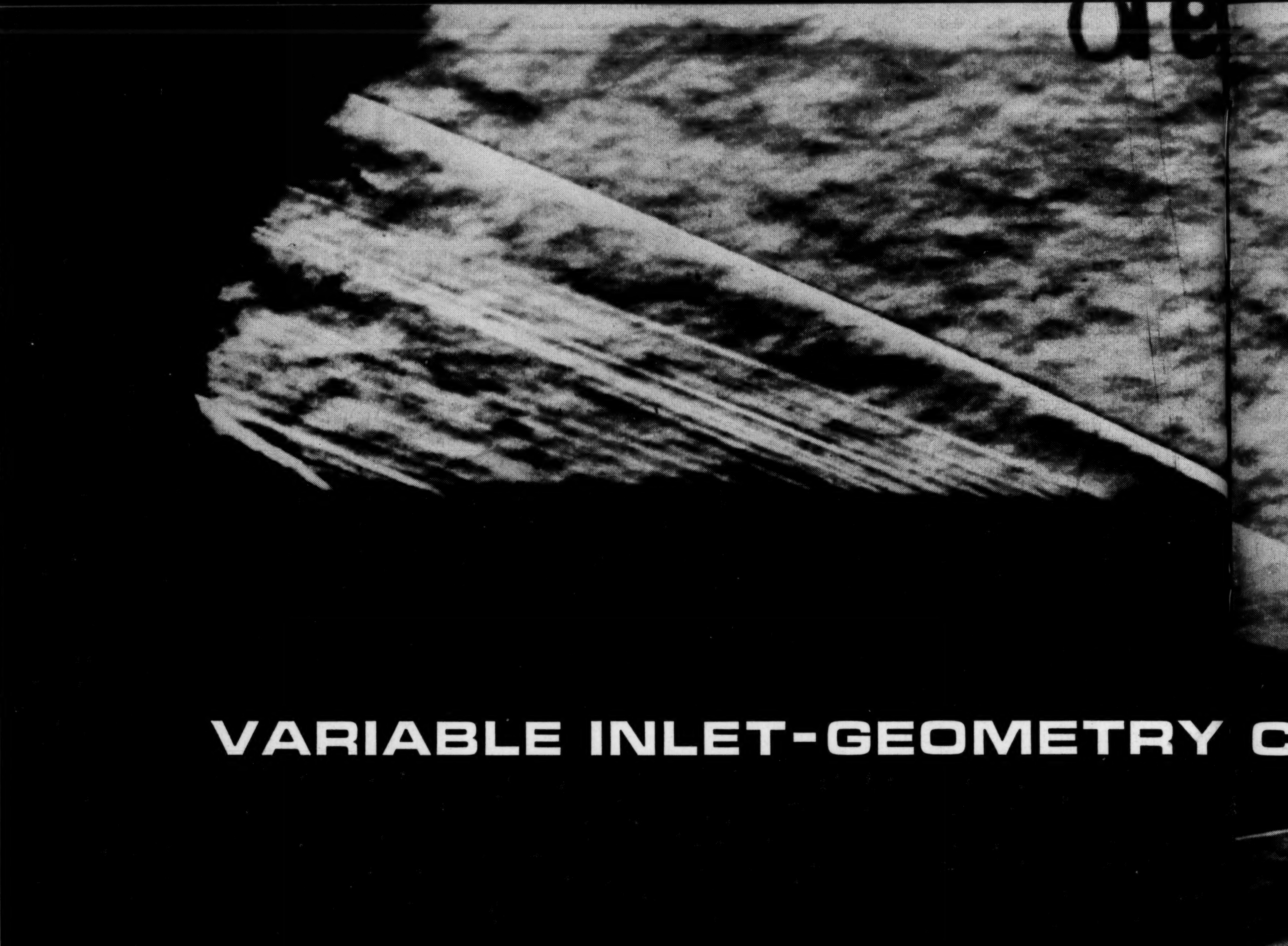
For specific details write: Mr. G. U. Newton, Personnel Office, Atomics International, 8900 DeSoto Avenue, Canoga Park, California.

ATOMICS INTERNATIONAL
DIVISION OF NORTH AMERICAN AVIATION



VARIABLE INLET-GEOMETRY C

SCHLIEREN PHOTO of shock wave pattern at Mach 3, taken in United Aircraft Corporation supersonic wind tunnel—one of several advanced facilities used to develop Hamilton Standard variable inlet-geometry controls.

For flight above Mach 2, effective control of inlet pressure recoveries is indispensable to aircraft performance and safety. Primary control depends on an optimum variable-geometry duct design. But because of the wide range of air-speeds and densities encountered, precise, automatic control of the inlet geometry is vital. A comprehensive inlet control system is, consequently, an essential design consideration. Through its ability to reliably sense, compute, and correct for extreme environmental forces, an accurate variable-geometry control system can assure ideal inlet pressure recoveries through any flight regime.

Hamilton Standard has already designed and developed complete inlet control systems which fulfill these requirements. These systems, for active aircraft programs, incorporate such advanced control devices as . . .

key to the high Mach airplane

- a Mach sensor with a response time of less than 30 milliseconds, accurate to ± 1% at temperatures up to 600°F.
- a compact closed-loop hydromechanical subsystem which controls pressure ratios in ambients above 1000°F and tackles multi-ton loads with a hydraulic actuator, requiring as little as 30 HP.
- a buzz sensor which effectively discriminates between normal transient pressures and abnormal pressure instability.

Hamilton Standard advances in variable geometry controls are a direct evolutionary result of the company's work in—hydromechanical, electromechanical, pneumatic, and hydraulic systems—for aircraft past and present. These technologies form a ready pool of design and developmental ability for meeting future ultra-high Mach requirements. Your inquiry is invited.

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Columbus, Ohio

Space Guidance Methods Detailed by ARS

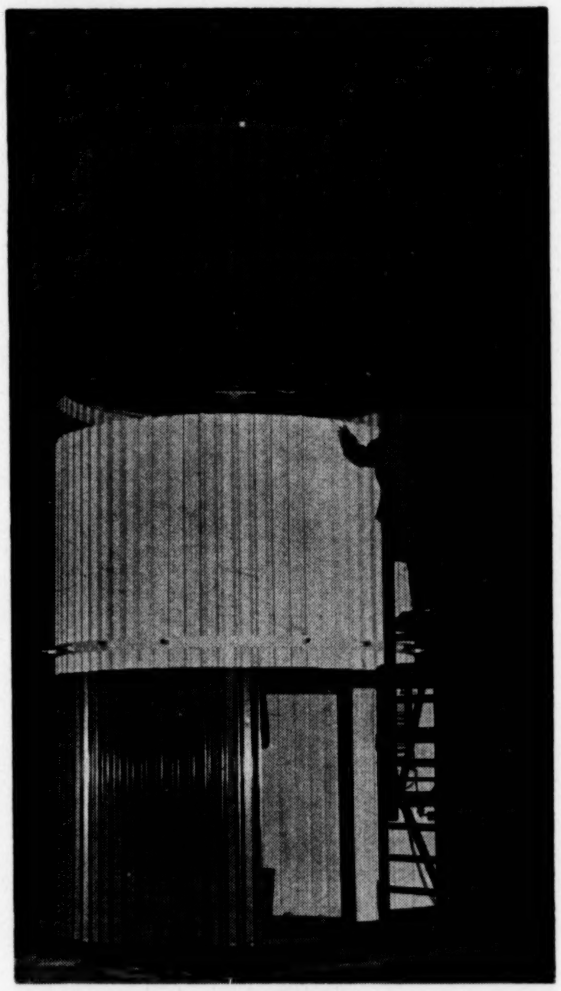
By Philip J. Klass

Stanford, Calif. – Automatic star tracker for space vehicle attitude control and mid-course guidance, expected to indicate star position with an error of less than 10 sec. of arc, was reported here during the recent Guidance, Control and Navigation Conference, co-sponsored by the American Rocket Society and Stanford University.

The new 25-lb. tracker, designed to locate and lock onto stars of sixth magnitude and brighter within a 50-deg. cone of view, is being developed by General Electric's Missile and Space Vehicle Department, Dr. D. R. McMorrow said. The device is expected to be operational within several months, McMorrow told Aviation Week. Tracker power consumption is expected to be less than 25 watts.

The more than 600 engineers and scientists who attended the conference also heard reports on the following:

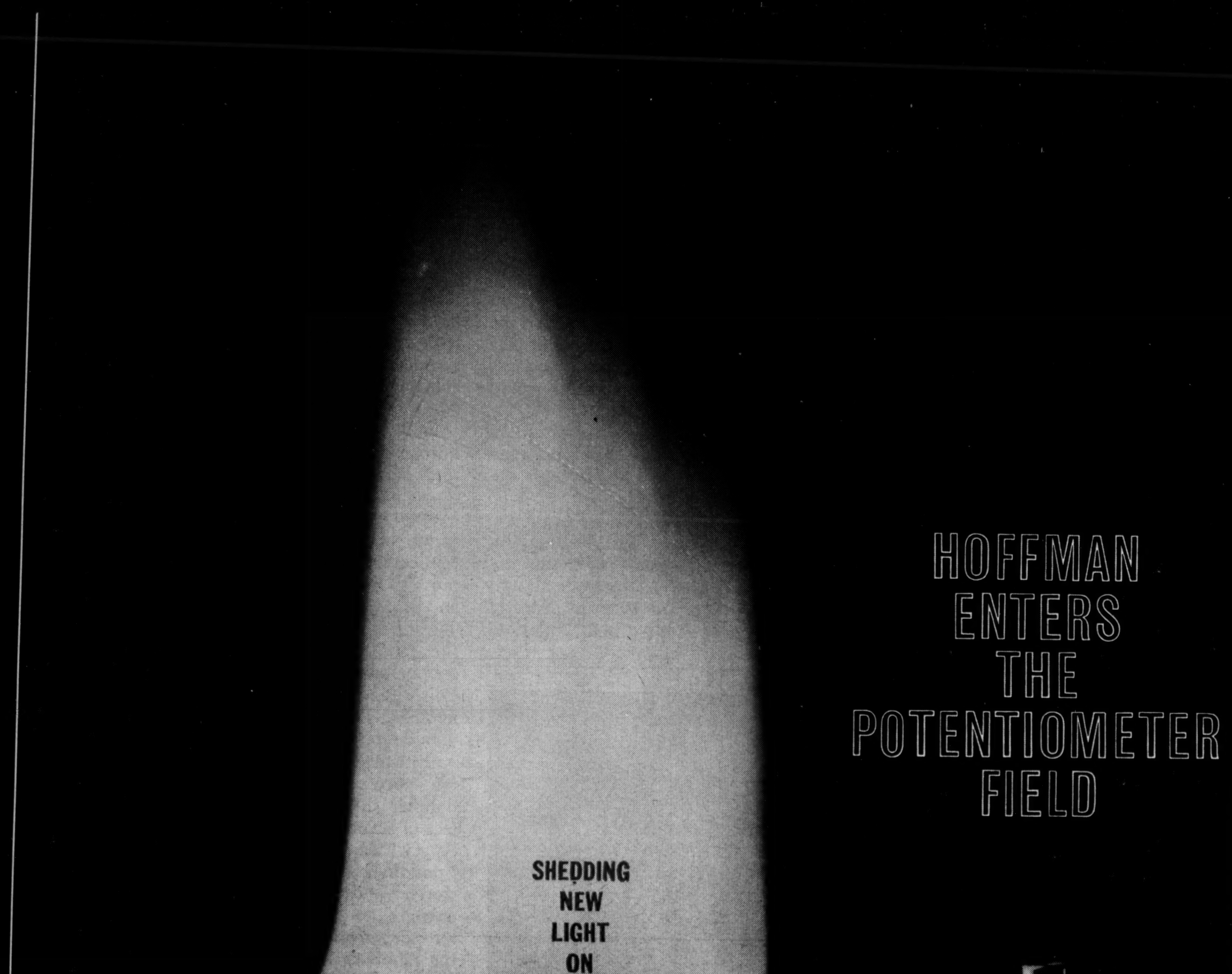
- **Use of angular accelerometers** instead of gyros for ballistic missile autopilot stabilization can eliminate instabilities caused by bending mode deflections of the missile frame. Aeronutronic's Walter R. Evans and Joseph H. Jerger proposed the use of suitably placed accelerometers whose signals are weighted according to vehicle mass distribution, then added to provide a direct measure of the force and torque acting on the missile which is independent of bending mode deflections.
- **Recent advances in cryogenic gyro** techniques suggest that "we may have a super gyro within a very few years," Jet Propulsion Laboratory's John T. Harding said. JPL's cryogenic gyro effort has been directed at researching basic problem areas rather than attempting to build an operational unit, Harding said. Measurements made on a one-inch gyro ball machined from 99.7% pure niobium and lapped to a sphericity of 0.0001 in., showed a total torque due to non-sphericity including mass unbalance flux of about two dyne-centimeters, with torque due to trapped magnetic flux of about 100 dyne-cm., Harding said. JPL is investigating use of a lightweight rotor made of alumina which is vapor-coated with a superconductive niobium surface, he added.
- **Inverted-umbrella type** drag brake, whose braking area can be varied (modulated) appears to be an attractive means for providing many control functions for re-entry vehicles, Avco's W. E. Vander Velde and J. E. Hayes reported. The drag brake can be used to orient the vehicle while in orbit, initiate its re-entry, and control the vehicle's landing point accurately. Additionally, the drag brake can be used to dissipate re-entry heat by serving as a large radiator, the Avco scientists reported. Because the drag effect will vary over wide limits due to corresponding variations in atmospheric density at different altitudes, the exposed brake area would be controlled from signals provided by an accelerometer on the vehicle to give the desired amount of deceleration at any instant during re-entry. To provide precision control, the accelerometer would need to operate over a 2,500 to 1 acceleration range. Avco's research in modulated drag brakes was sponsored by USAF's Aeronautical Systems Division.
- **Resistor with a "memory,"** called a "memistor," suitable for use in constructing artificial neuron circuits for use in self-learning control systems, was described by Bernard Widrow, Electrical Engineering Department, Stanford University. The memistor is a three-terminal device in which the conductivity (resistance) between two of its terminals is a direct function of the time-integral of the current in the third terminal, rather than the instantaneous value as for a transistor. The device consists of a conductive substrate with insulated connection leads and a metallic anode, all in an electrolytic plating bath. Memistors produced to date have a resistance which is continuously variable between approximately 1 and 100 ohms over a time interval of about 10 seconds with the application of several milliamperes of plating current, Widrow said. At present, memistors are made by grinding down small 0.1-watt carbon resistors so that a flat graphite surface is obtained with resistor connections exposed. Light coats of rhodium provide a smooth substrate for plating and protect the copper lead connections. These connections are insulated and the substrates are sealed in individual copper plating baths in polystyrene cells. Improved techniques and configurations for making memistors are under investigation, Widrow said.



Remote VOR Beacon

Standard Telephone & Cables, Ltd., currently is testing this VOR beacon designed for unattended, remote controlled operation in two versions, 50 watt and 200 watt. Beacon is in three sections, each 10 ft. in diameter. Middle section, which has 12 equally spaced vertical slots, acts as resonant cavity and also forms the radiating portion of the beacon. Transmitter and automatic changeover equipment is in the bottom, and top section forms an extension to the radiating walls of the center section.

- **Optical doppler system** for determining space vehicle velocity by measuring doppler shift of sunlight was the subject of several reports at the conference. R. G. Franklin and D. L. Birx of Franklin Institute Laboratories for Research and Development said that changes in velocity of about one kilometer per second had been measured in the laboratory using template spectroscopy and that it may be possible to increase this sensitivity by a factor of 100:1. A more attractive technique for measuring doppler shift of sunlight, suitable for measuring velocities in the range from 0 to 1,000 meters/sec., is the use of optical heterodyning, possibly with optical masers, the authors suggested. A system using optical masers would ease bandwidth requirements for the detection elements, eliminate the need for a high-frequency receiver and minimize internal noise problems. The Franklin Institute studies were sponsored by USAF's Aeronautical Systems Division. R. N. Norton and R. L. Wildey of Jet Propulsion Laboratory were less optimistic over the possible use of such an optical doppler system. Their investigation of line-broadening and shifting mechanisms in stellar atmosphere (including that surrounding the sun), indicates that a variability of about 200 fps. may be expected in an observer's measured optical doppler velocity, in addition to errors or limitations of the instrumentation itself. It is this which imposes a fundamental limitation on the accuracy of a solar doppler velocity system,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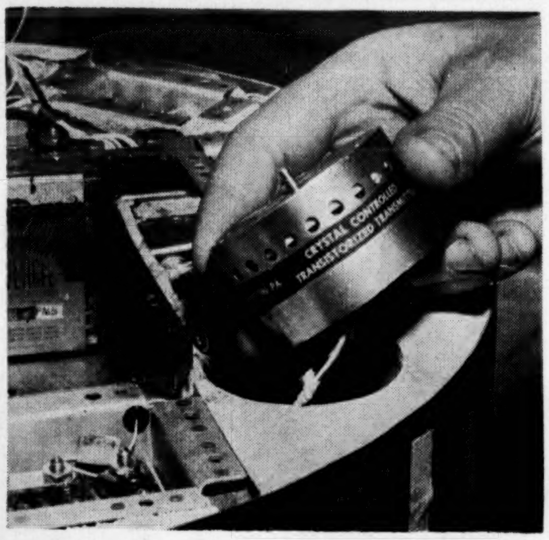

Small Telemetry Unit

New USAF Digilock telemetry system, for small research rockets., weighs only 12 lb. including 7 lb. of batteries. System, developed by Space Electronics Corp., is expected to achieve ranges of at least 100,000 mi. using ¼-watt transmitter through use of extremely efficient digital coded transmissions. The crystal-controlled phase-modulated transmitter, fully transistorized and weighing 7 oz., is made by Vector Manufacturing Co. System's first flight will be aboard a USAF Blue Scout Junior rocket later this year to measure radiation in space.

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rather than instrumentation, the authors believe.

- **Path-adaptive guidance mode,** developed for the Saturn space vehicle to accommodate loss of one or more engines during flight and to provide greater latitude of launch time for difficult space missions, was described in two reports by W. E. Miner, D. H. Schnieder and N. J. Braud, all with the George C. Marshall Space Flight Center. In the path-adaptive guidance mode, a digital computer aboard the vehicle will compute the local thrust vector alignment required for the optimum path from the measured vehicle coordinates to the desired mission conditions, based on the measured performance parameters. Vehicle will then be steered to correct the error between the measured thrust vector direction and the computed value.
- **Attitude control of space vehicles** using earth's magnetic field, for vehicles where long lifetime precludes use of mass-dispensing systems for dumping angular momentum, was described by A. G. Buckingham of Westinghouse Electric's Air Arm Division. Vehicle would be equipped with three mutually perpendicular coils for transferring momentum and three mutually perpendicular inertia wheels for storing momentum and generating desired angular motions. Unwanted momentum stored in inertia wheels (from previous maneuvers) would be measured by tachometer generators driven from the wheels to provide signals proportional to magnitude of momentum. A magnetometer would measure components in three orthogonal directions of the earth's magnetic field. A simple analog computer could then determine how much current must be supplied to each coil to develop required momentum transfer torques. For vehicles operating at altitudes below approximately 40,000 mi., where an operational life of more than several weeks is required, the electromagnetic system described is lighter and occupies less volume than mass-dispensing systems, Buckingham said.
- **Precise stabilization** of space vehicles in highly eccentric orbits to an earth-vertical will prove extremely difficult due to the complex kinematics of the problem, Dr. Paul H. Savet of American Bosch Arma Corp. reported. His analysis indicates that the vehicle will oscillate at three different frequencies: Schuler frequency of the forcing function, natural frequency within the orbital plane and a natural frequency perpendicular to the orbital plane.
- **Solar radiation pressure** is another source of perturbation for space vehicles, R. J. McElvain of Space Technology Laboratories said. Results of an STL analysis indicate that solar radiation pressure may produce torques that are either periodic or constant with respect to inertial space, depending upon the orbital inclination of the vehicle relative to the ecliptic plane, the

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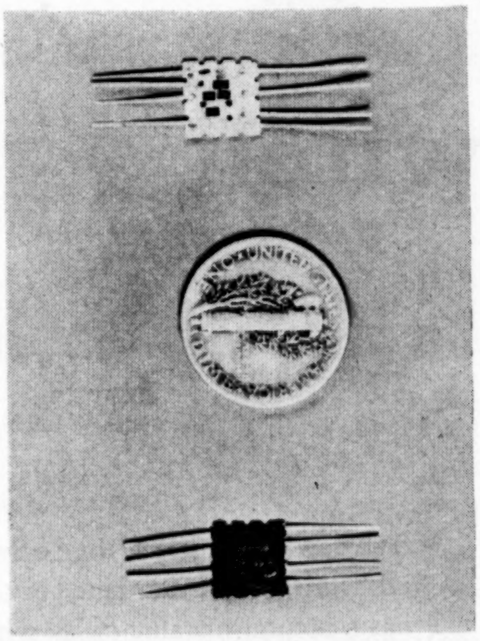

Flip-Flop Circuit

New microminiature flip-flop circuit, consisting of 12 unencapsulated components, each passivated by silicon oxide film, and mounted on ceramic substrate measuring 0.31 x 0.31 in., suitable for use in Army/RCA Micro-Modules, is now available from General Instrument Semiconductor Division. Each flip-flop consists of six semiconductor resistors, two silicon dioxide capacitors, two epitaxial planar transistors and two fast-switching planar micro-diodes. Components are interconnected by gold printed circuit. Device is called a "nanocircuit." Company's address: 65 Gouverneur St., Newark, N. J.

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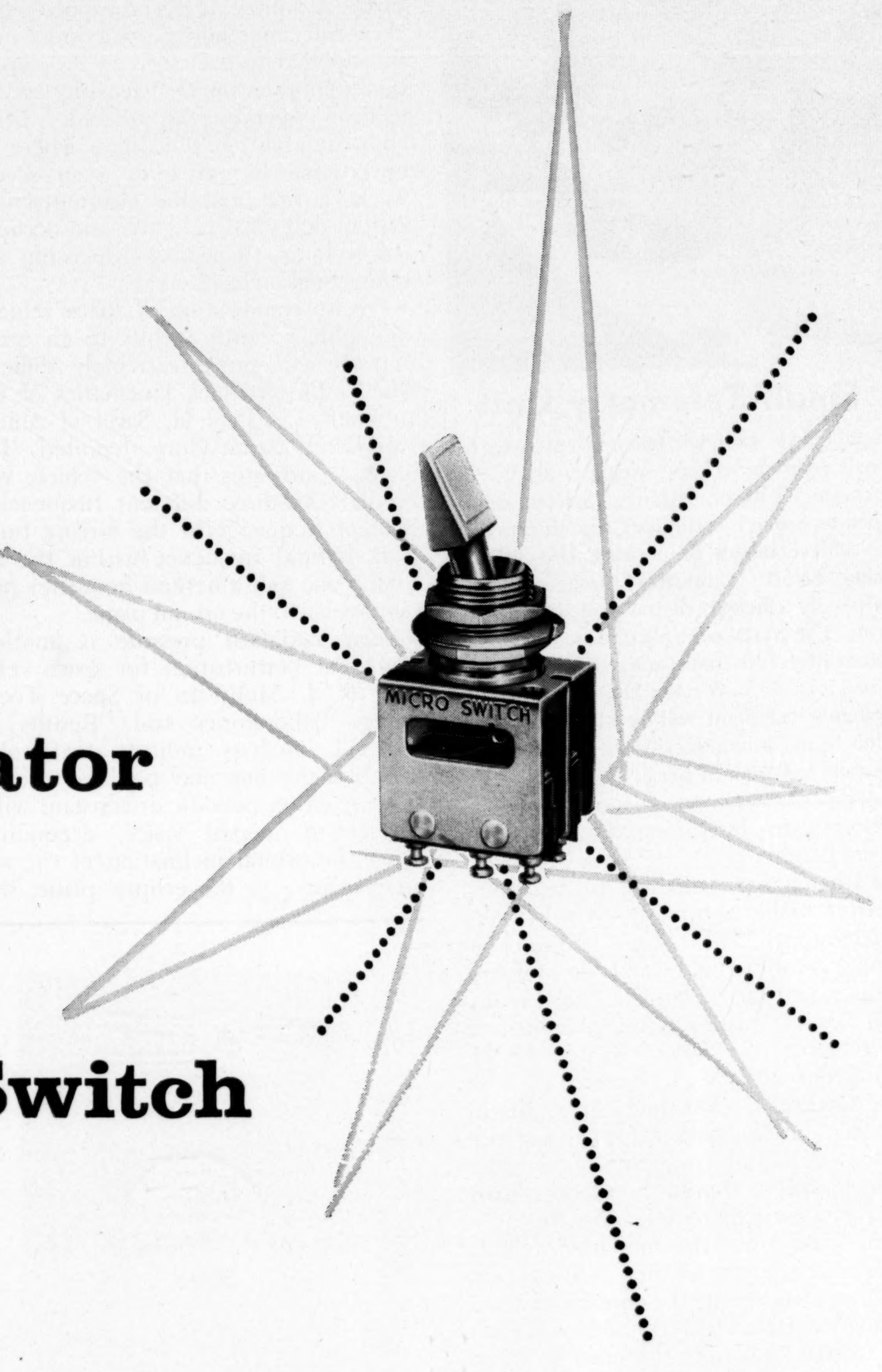

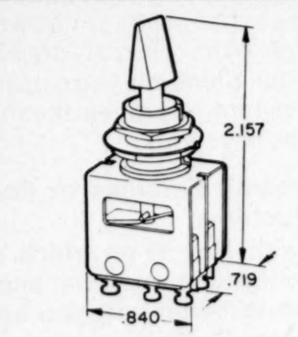

"400" SERIES TOGGLE SWITCHES
Five models available, including 2-position and 3-position types. All are rated at 5 amperes, 250 vac.

The new "400" Series Toggle Switch from MICRO SWITCH has a paddle-shaped tab which can be numbered or color-coded as an indicator. The standard model has a natural metallic finish which will maintain a fresh appearance through long and constant use. The anodized aluminum tab is also available in black or in colors.

The basic switches used are precision snap-action, long-life units, requiring a minimum of space. They conform to specifications for MIL-S-6743, with two isolated single-pole double-throw circuits. Turret terminals make wiring easy, and contact enclosures are dust-tight.

Five models are presently available in the "400" Series, including both momentary and maintained contact types. Write for Data Sheet No. 174 describing these new tab-indicator toggle switches.

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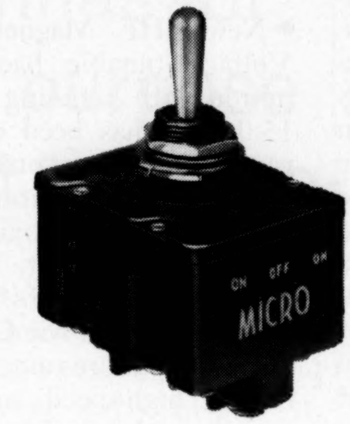
"1TL" Series



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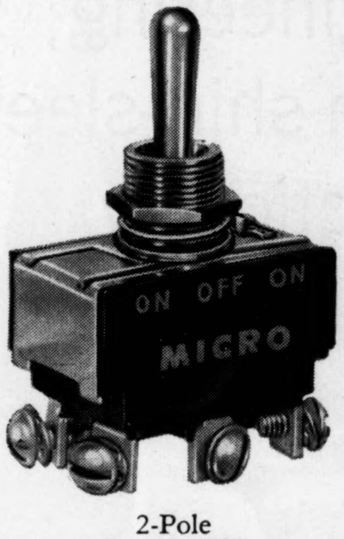
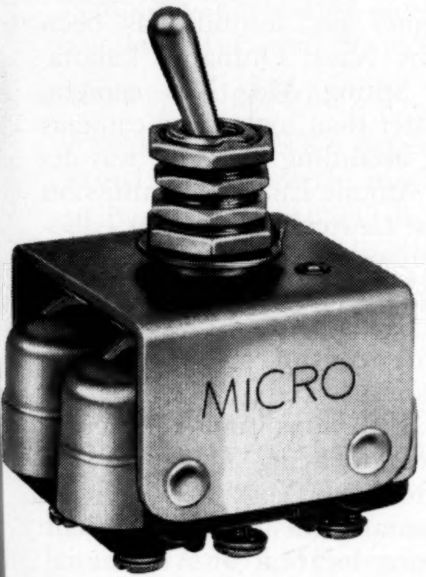
"1TL" Pull-to-Unlock

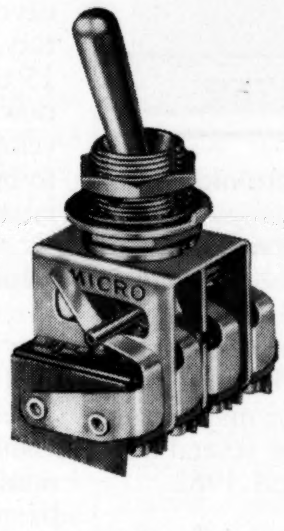
1-Pole "TS"



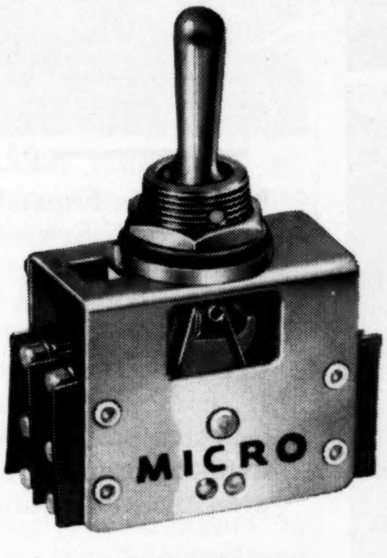
2-Pole
Sealed "TS"



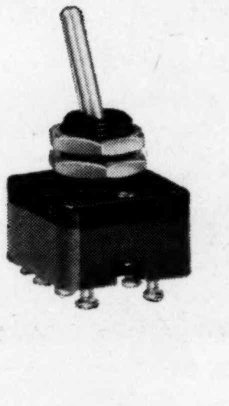
Hermetically Sealed
Assembly



4-Switch Assembly



"Electrical Memory"
Assembly



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Precision Toggle Control Can Be Customized

MICRO SWITCH manufactures hundreds of different toggle switches and toggle switch assemblies. In this complete line you can find the exact characteristics and contact arrangements you need.

"TL" Series Silicone sealer between cover and case seals against dust or moisture. These switches are approved under MIL-S-3950A, operate in a temperature range of —85°F to +250°F. Available in 1, 2 and 4-pole models with integral terminals.

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WRITE FOR NEWLY REVISED CATALOG 73 ON TOGGLE SWITCHES

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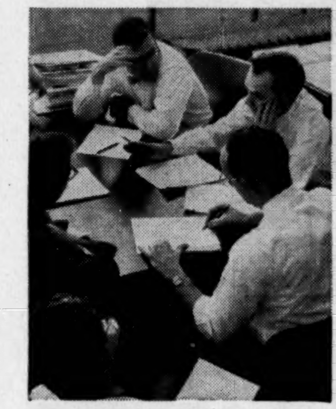

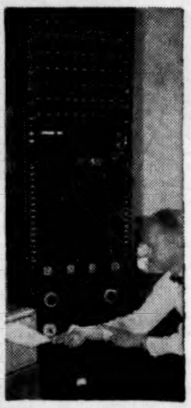

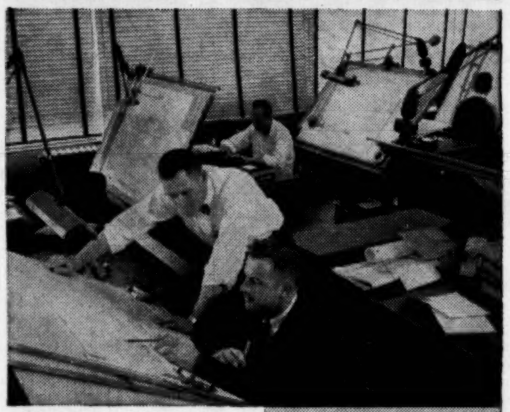

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orientation requirements and the vehicle's configuration, McElvain said.

- **New approach** to pulsed-jet attitude control, designed to minimize propellant consumption yet provide stable control without need for rate signals, was reported by R. S. Gaylord and W. N. Keller of Space Technology Laboratories. The system employs pulsed signals whose duration is the minimum on-time of the propellant valve. The system controls vehicle attitude by pulse torquing according to error limits and damping the motion in a non-linear fashion by using phase-plane quadrant information only. The knowledge of the quadrant is obtained by using the characteristic of the phase plane that an increasing error magnitude defines the first and third quadrants. Thus, only if the error is increasing in magnitude should control action be taken, the authors said.

FILTER CENTER

▶ **USAF to Expand Molectronics Effort**—Air Force Systems Command's Electronic Technology Laboratory, which funded more than $5 million in molectronics programs in Fiscal 1961, hopes to double the effort in the coming year. If developments now under way show expected promise, Air Force may expand its molectronics program by several hundred per cent during Fiscal 1962.

▶ **USAF Divides Infrared Responsibilities**—Within the next 60 days, Aeronautical Systems Command's Avionics Directorate will reassign responsibilities for applied research in infrared detectors. Reconnaissance Laboratory will be responsible for infrared detectors intended for use at wavelengths shorter than 300 microns, while those for use at longer wavelengths will be assigned to Navigation and Guidance Laboratory. Avionics Directorate's Electronic Technology Laboratory will monitor programs in new infrared detector materials.

▶ **Bendix VOR Has Self-Check Feature**—New NVA-22 omnirange navigation receiver developed by Bendix Radio has built-in circuitry which enables pilot to check its operation in flight. When pilot pushes test button, VOR indicator will display station bearing of zero degrees if equipment is operating properly.

▶ **UAL Computer Checks Autopilots**—New analog computer has been developed by technicians at United Air Lines San Francisco maintenance base which can check dynamic performance of an automatic pilot in 30 min. or less. Previously, static testing of malfunctioning autopilots required as long as 8 hr., and did not assure that autopilot would function properly in flight. Dynamic performance of airplane and simulated airplane is recorded on a Brush six-stylus recorder.

▶ **New SHF Magnetron Developed**—Voltage tunable backward-wave magnetron with a tuning range of 10.8 to 15.0 kmc. has been developed by Sylvania under sponsorship of Electronic Technology Laboratory, Dayton. New tube provides approximately 100 watts of cw. power output.

▶ **High-Speed Movie Camera Developed**—Motion picture camera for filming and timing high-speed motion simultaneously in color and black-and-white, recording single frame action at 20 billionths of a second while taking one million frames per second, has been developed by Naval Ordnance Laboratory, Silver Spring, Md. New camera, 15 times faster than high-speed cameras now in use, according to NOL, was developed for Atomic Energy Commission to be used at Lawrence Radiation Laboratory, Livermore, Calif.

▶ **Intercept Radar Speeds Refueling**—Intercept fire control radar on three Navy/McDonnell F4H-1's which recently broke previous transcontinental speed record by flying nonstop from California to New York in 2 hr. 48 min., cut aerial refueling time in half by pinpointing location of A3D aerial tankers, according to Westinghouse Electric, whose Air Arm Division developed the fire control system. New Westinghouse radar has greatly improved range over previous interceptor systems, the company says.

▶ **Physiological Data Acquisition**—A viability data acquisition system which will gather physiological data from instrumented men or chimps located in an environmental chamber at Holloman AFB will be built by Spacelabs, Inc. System which can gather environmental as well as the physiological data will include magnetic recording devices, analog-to-digital conversion gear and display consoles.

▶ **Four subsidiary companies** of S. Smith & Sons (England), Ltd., have been merged to form Smiths Aviation Division, with headquarters at Wembley, Middlesex. Companies are Smiths Aircraft Instruments, Kelvin & Hughes, Weymouth Gauges & Instruments and Kelvin & Hughes (Aviation). Officers are R. Gordon-Smith, chairman; L. A. Morgan, general manager; A. M. A. Majendie, deputy general manager, L. C. Harman, administration director, and K. Fearnside, technical director. D. G. Johnson has been appointed chief technical sales executive.

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For more information, write American Machine & Foundry Company, Government Products Group, 261 Madison Avenue, New York 16, N.Y.

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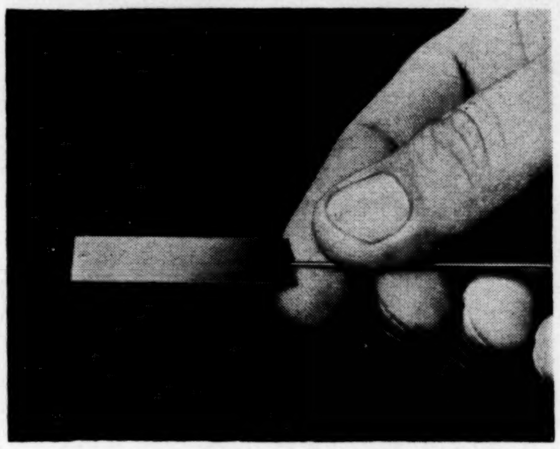
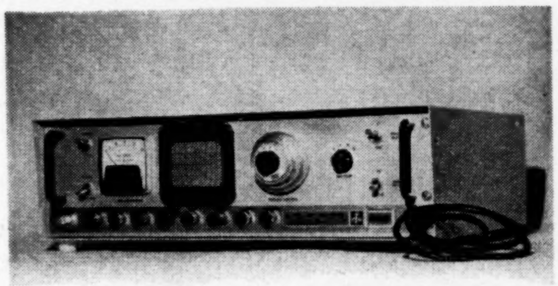
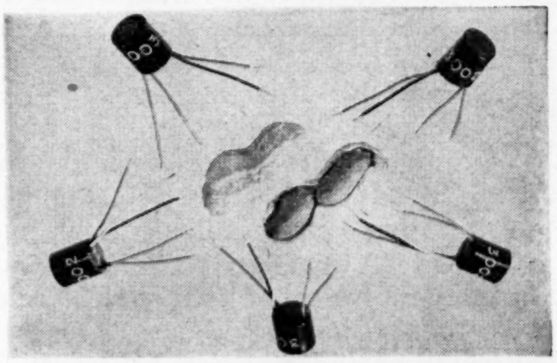


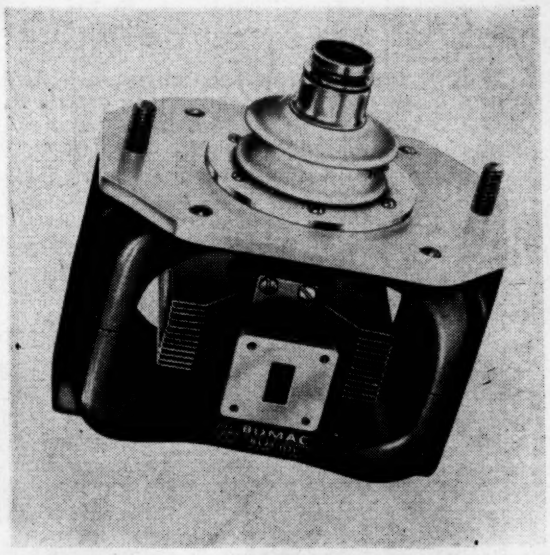
- **Resistance - temperature transducer,** Model 2508, for measuring temperatures meets or exceeds vibration and shock specifications of MIL E 5272C. Transducer measures $1\frac{9}{16}$ in. x $\frac{9}{16}$ in. x 0.014 in., will provide continuous operation from zero F to 2,000F, and can be installed with millisecond response times. Resistance of platinum sensing element is 100 ohms ± 1% at 77F. Manufacturer: Winsco Instruments & Controls Co., 11789 W. Pico Blvd., Los Angeles 64, Calif.



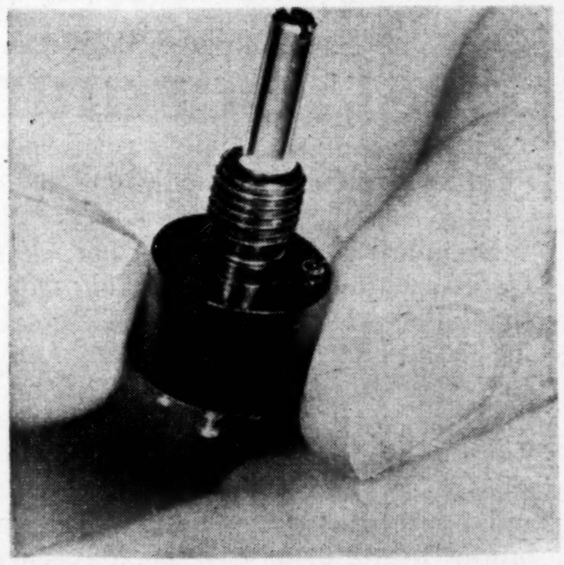
- **Voltage/phase comparator,** Model IPN-400, contains cathode ray tube and precision voltmeter for accurate measurement of phase shifts and voltage ratios. Self-contained unit occupies $5\frac{1}{4}$ in. of panel area or can be employed as portable unit and has a variety of applications with a.c. signals in range from 25 cps. to 10 kc. with measurement accuracy of ± 0.1 deg. Manufacturer: Autonetics Division of North American Aviation, Inc., 9150 E. Imperial Hwy., Downey, Calif.



- **Micro transformers,** including models with balanced four winding designs for differential input parallel circuit isolation or other instrumentation. Custom types made to specs are available. Manufacturer: James Electronics, Inc., 4050 No. Rockwell St., Chicago 18, Ill.



- **Magnetron,** BLM-071, a Ku-band pulse unit for airborne radar systems, provides 100 kw. of peak power at a 0.001 duty cycle. Frequency range for the tube is 15.9 to 16.1 gc. Pulse duration is 0.06 to 1.2 microsec. Input/output terminals may be pressurized to 30 psia. Manufacturer: Bomac Laboratories, Inc., Salem Rd., Beverly, Mass.



- **Trimmer potentiometers,** produced by chemical fusion of an oxide at high temperatures on a glass substrate, thereby providing unit with stepless resolution. Potentiometers have ambient temperature range from −65 to +150C, can withstand 30g shock and 20g vibration from 20 to 2,000 cycles. Temperature coefficient is 50 parts/million/degree C. Manufacturer: Intellux, Inc., 30 So. Salsipuedes St., Santa Barbara, Calif.

- **Automatic synchro/resolver tester,** Model C05-3802-004, will automatically test 60 and 400 cycle synchros or resolvers from Mil size 08 through 37. Tests include no-load quadrature current (± 3%), no-load reference current (± 3%), fundamental null voltage (± 3%), total null voltage (± 3%), transformation ratio (± 0.2%), error from electrical zero (± 30 sec.) and phase shift (± 1 deg.). Tester measures 60 in. high, 45 in. wide, 50 in. in depth and weighs 1,000 lb. Manufacturer: Kearfott Division, General Precision, Inc., 1150 McBride Ave., Little Falls, N.J.

FRITZ FREYTAG (arrow), technical director and chief designer of East Germany's Type 152 medium-range four-jet transport, fled to the West last October after East Germany halted all aviation programs. Photo was taken at time of 152 rollout in 1958.

East Germans Scrap 152s in Production

By Cecil Brownlow

Bremen—Costly facilities of East Germany's once-budding aviation industry, killed off as it neared a climax in its design efforts, now are busily being converted to the production of such items as potato planters, prefabricated windows, bridging and industrial engines. Completed prototype transport and powerplant designs as well as ambitious future plans have been assigned to the same scrap heap in one non-discriminating swoop.

Wind tunnels, hurriedly erected to give substance to East German hopes of developing a strong domestic industry, stand idle along with related special tooling that cannot be adapted to other purposes. Aeronautical engineers, on governmental order, are directing their attention to window frames instead of airframes.

Severe, but economically necessary, decision to halt all aviation design, development and production activity (AW Mar. 27, p. 28) came at a time when series manufacture of the Type 152 four-engine medium-range jet transport, first tangible result of the East German drive to gain international stature in the aviation field, was moving ahead at an accelerated pace and newer, more sophisticated models were on the drawing boards.

Components for a total of 20 Type 152s, for which a new and expensive industry had been built almost from scratch, had been or were being fabricated at the time of the cutoff. The second prototype, incorporating several design changes over the first, was following its flight test schedule and a third had completed the major goals in its stress analysis program.

A fourth aircraft was in the final assembly stage at the state-owned aircraft enterprise, VEB Flugzeugwerke Dresden, when Fritz Freytag, the firm's technical director and chief designer, fled to the West last October.

Key Departure

At the time of Freytag's departure from Dresden, the fuselage of the fifth aircraft was being mated to its wings and tail while awaiting delivery of its four Pirna 014 A-1 turbojet powerplants of 6,945-lb. thrust each from VEB Industriewerke Ludwigsfelde near Berlin. Under the East German structure, Ludwigsfelde was responsible for actual production of turbojet engines while their design, development and improvement was the primary responsibility of VEB Entwicklungsbau Pirna near Dresden.

Fuselage, wings and tailplane of the sixth aircraft also had been completed by this time, and components for another 14 transports were being manufactured. Over-all, the Type 152 development and production program, although behind schedule, was ready to begin dividend payments, according to Dr. Freytag, who is now associated with Weser Flugzeugbau GmbH. here.

Initial deliveries to East German Deutsche Lufthansa had been scheduled for late 1961 or early next year, and the government, working within its Soviet assigned sphere of relatively light transport designs and low-thrust turbine powerplants, had hoped to break into the Western export market with the aircraft.

For series production, the Dresden plant, which Freytag helped plan and build from the ground up, had two large 525-ft.-long manufacturing and assembly shops, with tooling in place and in operation at the time of the cutoff.

In the West, at least, the program had seemed to get off to an inauspicious beginning when the first 152 prototype was destroyed on Mar. 4, 1959, during its second flight from Dresden after a series of fixes had followed its initial trial the previous Dec. 4.

Freytag, however, attributes the crash, at a point about five miles from the Dresden plant, to pilot error—a stall at an altitude of approximately 1,000 ft. from which the pilot was unable to recover—and says modifications to the second aircraft had been planned well before the accident. The prototype itself was a complete loss, exploding on impact as Freytag and his associates watched from the plant.

The second prototype made its initial flight on Aug. 26, 1960. The second and last flight before Freytag left followed on Sept. 4. The flight test program, however, is believed to have continued to the time it was ordered to a halt by the government.

Modifications to the second prototype included a repositioning of the main landing gear structure and elimination of the auxiliary outrigger system located on each wingtip. In the first prototype, a bicycle four-wheel bogie unit extended and retracted into the center fuselage section, with a forward two-wheel bogie beneath the nose. In the second, the main fuselage gear was replaced by four wheels housed in each wing in a pod to the rear of the underslung engine pylon at a point between the exhausts of the two Pirna engines (AW Mar. 21, 1960, p. 76).

While the outrigger gear unit was eliminated, its wingtip housing pods were retained, primarily to avoid any major design modifications that might have been necessary to prevent flutter had they been removed. They were adapted instead to the role of tip tanks, with each carrying approximately 160 U. S. gal. of fuel.

The glassed-in nose section for the navigator in the prototype—a favorite fixture on Soviet designs—also was eliminated on the second model.

The 152, with a 35-deg.-sweep high wing, was designed to carry a maximum of 73 passengers in five-abreast tourist configuration over normal stage lengths of 1,200 stat. mi. Maximum range without reserves was 1,865 mi. Cruising speed at 35,000 ft. was 497 mph., according to Freytag, while maximum speed at 15,750 ft. was 572 mph.

Takeoff run at the maximum gross weight of 112,455 lb. was 3,610 ft. Landing roll at a gross weight of 77,200 lb. was 2,260 ft.

Possible Follow-ons

As possible follow-ons to the 152, whose development actually was begun by Freytag and other German engineers in early 1954 while they were still working in the Soviet Union, the Dresden plant had several new designs in the making—the most promising of them a twin-turbine low-wing transport conceived as a replacement for Russia's obsolescing piston-engine Il-14.

Most radical design departure in the 40-passenger aircraft, designated Type 155, was Freytag's plan to locate the two Pirna O14 A-1 powerplants in pods attached to the upper wing surfaces, each at a point approximately 31.5 in. from the fuselage. Design cruise speed of the straight wing aircraft was 435 mph. over a maximum range of 1,000 mi. Normal planned stage lengths were approximately 500 mi.

At the time of Freytag's departure, the aircraft was still in the initial stages. A mockup had been built and between 200 and 300 detailed drawings had been completed—as opposed to the approximate total of 42,000 needed for the 152.

Earlier plans for a 70-passenger twin-engine turboprop transport, the 153, of about the same general size as the 152 and also making use of Pirna-designed powerplants were scrapped by Freytag after calculations showed that, with one engine out and without counter-rotating propellers, the aircraft would almost immediately be pulled into a sharp turn by the torque of the working powerplant and then fall into a steep, probably uncontrollable 30-deg. dive.

Use of counter-rotating propellers was out of the question, Freytag said, since design and production of the necessary gearing mechanism was beyond the East German state of the art at the time. The project was not abandoned, however, until after 2,000 drawings had been completed and a number of wind tunnel trials held to test out Freytag's theories. Proposed powerplant was the Pirna O18 with 5,000 shp.

Another Freytag design under consideration—the Type 154, a medium-range transport somewhat larger than the 152 and with greater range and payload capabilities—envisioned use of four advanced Pirna engines of 7,700-lb. thrust each located in clusters of two, one above the other, on the rear of the fuselage near the tail section.

Designs and actual aircraft, including the completed 152s which were broken up for scrap, hit the waste heap together last March several months after Freytag's defection when the East German government announced an abrupt halt to all aviation development activities in an effort designed to ease the spreading economic chaos within the country.

Officials of the plants, which had been laboriously built up from ground level since 1954 on a crash, prestige basis, were told that, rather than aircraft and engines, they would henceforth produce a series of goods designed to have an immediate impact upon the stagnating economy.

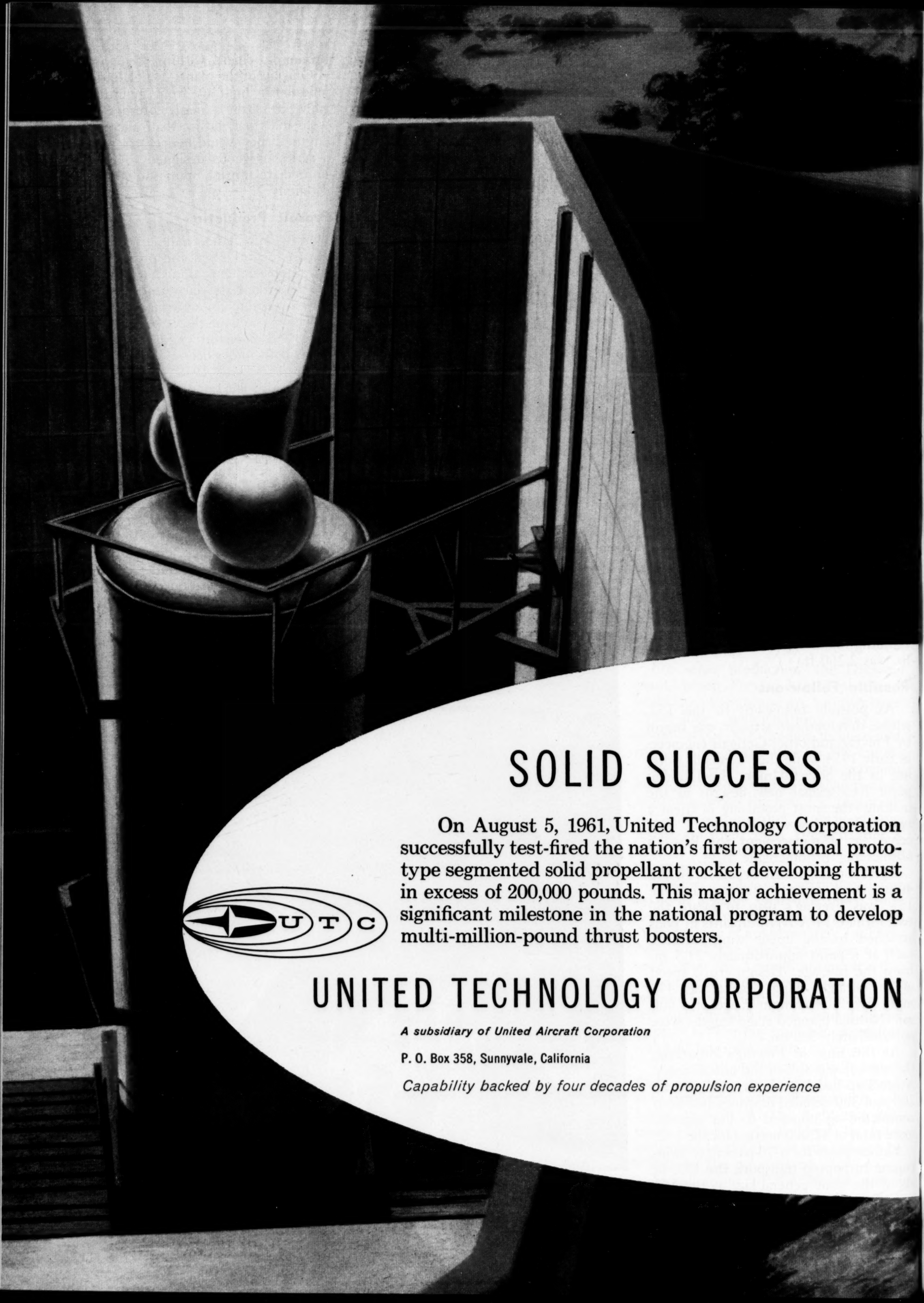
Prosaic Production

Dresden, Pirna and Ludwigsfelde turned to the design and production of more prosaic items along with VEB Industriewerke Karl-Marx-Stadt, East Germany's third major aviation facility. Improved versions of the Russian-designed Asch 82T-7 piston engine for the 80 Il-14s built under license at Dresden between 1956 and 1959 were produced over roughly the same time span at Karl-Marx-Stadt. Later, the plant turned to the production of other components for Dresden designs, including the 152 hydraulic system.

At its peak, the Dresden facility had a total of 9,800 workers, 1,700 of them engineers, and Freytag terms the design group working under him as "very good" by any standards. About 70% of the engineers were young Germans with an age span of between 23 and 35 who had received their education in the Soviet Union, Dresden and elsewhere.

The others, ranging between 40 and

FRITZ FREYTAG (center), former technical director and chief designer of VEB Flugzeugwerke Dresden, explains his jet transport designs to a group of East German officials beneath the nose of the second prototype of the now-scrapped Type 152.



SOLID SUCCESS

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LOW-SPEED tunnel shown at left had a maximum speed of 230 fps.

65 in age, had worked in Germany before and during World War II, as had Freytag, a chief project engineer at Junkers in Dessau from 1936 until his capture by the Soviets in 1945.

Over-all, the East German aviation industry had attained an employment figure of approximately 25,000 shortly before the government cutoff, consuming an inordinate number of the country's hard-to-find technical skill. Its West German counterpart, which began struggling back to its feet in 1956 two years after the initial East German moves but with a larger population and financial base to rely upon, now employs about 20,000 workers in a number of plants.

The urgency with which the East German government felt it had to divert this talent to other channels, and a probable indicator of the financial pinch it is facing, is evidenced by the fact that it decided to kill off the Type 152 completely rather than follow the program through at least to the point of delivering the five aircraft on hand or near completion to Deutsche Lufthansa for use as prestige equipment on international flights to the West, presumably a major goal of the industry during its years of near-maximum effort. Freytag estimates that the flight test program could have been completed for approximately $400,000 more.

Engineers Flee

There apparently is no plan to restore the industry to its original role at anytime within the near future. A number of its engineers have preceded or followed Freytag to the West. More have been scattered to bolster the technological efforts of other basic industries or diverted at their posts to other tasks.

Brunolf Baade, given official credit for design of the 152 and Freytag's predecessor as technical director at Dresden, is now in charge of a group of between 35 and 40 engineers engaged in the light design field on equipment completely divorced from aviation.

In the industry's prime, Baade, a former Junkers production engineer who worked in the U. S. between 1929 and 1936, was heralded as the man primarily responsible for its postwar rebirth. Its subsequent progress also was credited largely to his efforts. He receives little similar acclaim from Freytag and other former colleagues who maintain that his greatest assets are his Communist Party membership card and his ability to climb in party circles.

"Baade," one German engineer now in the West says, "has the ability to merge into whatever society he happens to be in. In Russia after the war, he was a Russian. Back in (East) Germany, he became a leading party figure. If he were sent to China tomorrow, he would become a Chinese."

After the crash of the first Type 152 prototype in the spring of 1959, Baade was shifted to the post of director of research at Dresden, and Freytag was assigned the joint roles of technical director and chief designer. This was generally interpreted in the West as a rebuff to Baade as a result of the accident. Freytag and others, however, contend that the two events were not related.

Baade, Freytag and other German technicians entered into the Soviet orbit after being caught by the Russian advance in the German heartland from the East in the summer of 1945—at the same time a number of their colleagues were falling into the hands of the West. In the case of Freytag, he was initially ordered to remain at his home in Dessau near the Junkers plant.

Then, in November, 1945, Freytag recalls, eight armed Russian soldiers appeared one night at his home and proceeded to surround it. An interpreter asked Freytag how much time he needed to get ready to move to the Soviet Union with his wife and two children—a son now 20, a daughter now 17.

"I said, oh, about two weeks. The interpreter said two hours."

And, within two hours they were on their way to the Dessau train station, their belongings stuffed into two American automobiles which the Soviets had provided.

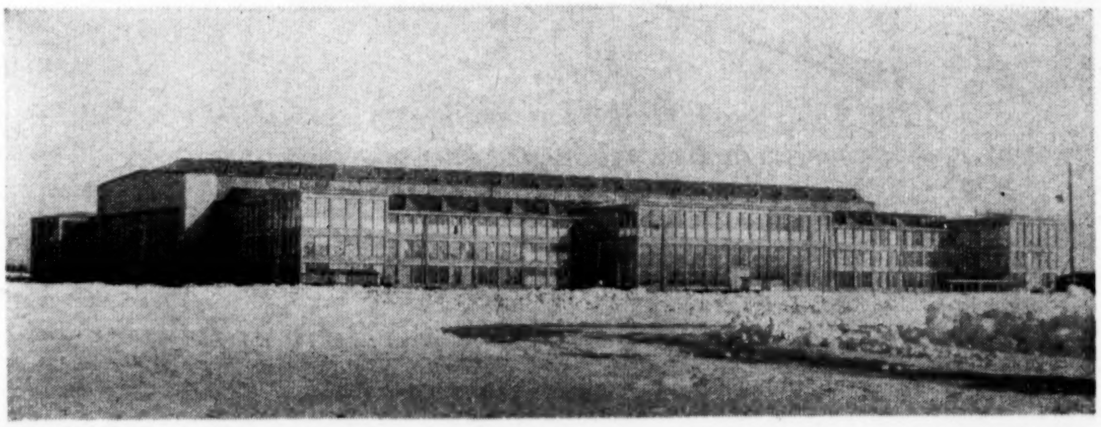
Freytag's New Assignment

At the station, they were ushered aboard a train, also equipped with armed Soviet guards, and began the journey to Russia that eventually landed them in the town of Podberesje about 72 mi. north of Moscow on the Volga Canal, the site of a former U. S.-supplied seaplane production and development base. For security, the production facilities had been moved beyond the Ural Mountains during the war, but the research facilities still remain, and Freytag, working with both German and Russian engineers, was given the task of completing the development of an embryonic Junker design for a six-engine turbojet bomber designated the Type 131 by the Soviets.

Development of the aircraft, powered by six Junkers-designed Jumo engines of 2,425 lb. thrust each which had been redesignated the RD-10 by the Soviets, was completed on a limited basis, and the Freytag team switched to a design version of the 131 designated Type 114. Projected powerplants for the 131, however, were of Russian design – 6,615-lb. thrust Mikulin engines.

In all, Freytag and his family remained in Russia until July, 1954, with his group working on a number of other designs, including a four-jet bomber begun in 1949, the Type 150, which remained in the experimental stage.

Freytag began work on the Type 152



HALL 22, 525 ft. in length, was one of two main assembly buildings erected at Dresden in support of the 152 and other transport designs.

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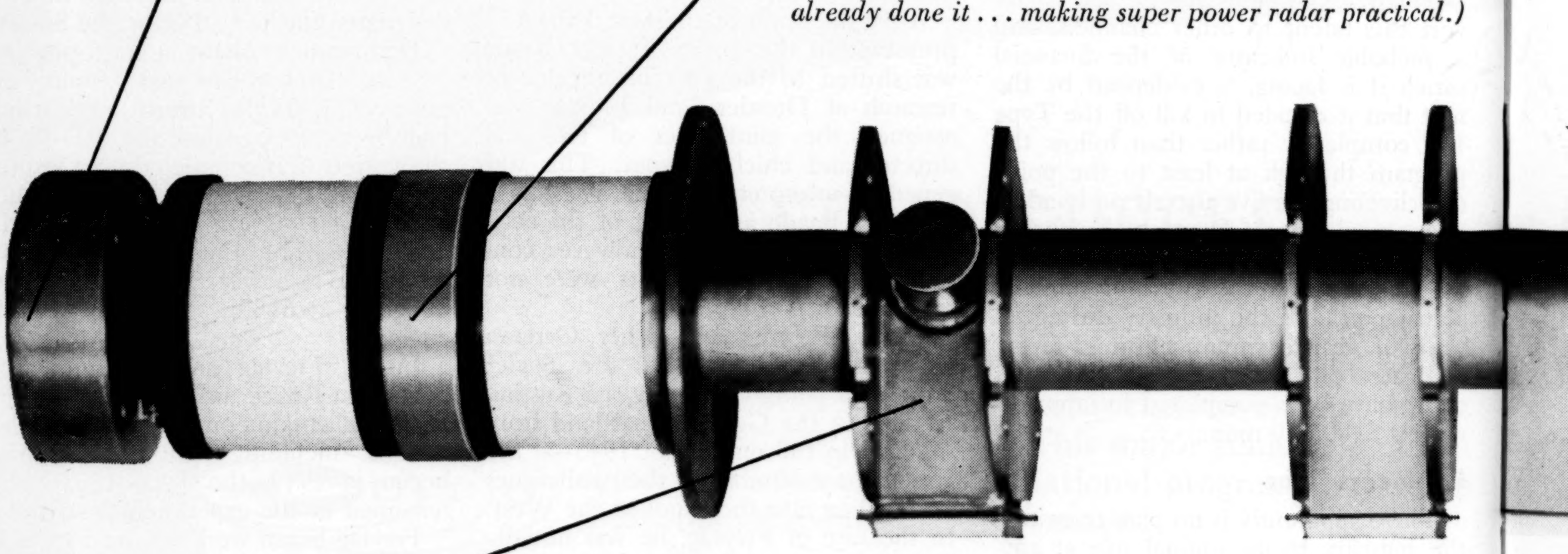

4. *Design your klystron with either an internal, an external, or a combined internal-external cavity to meet all power and frequency needs. (Only Eimac is able to do it today.)*

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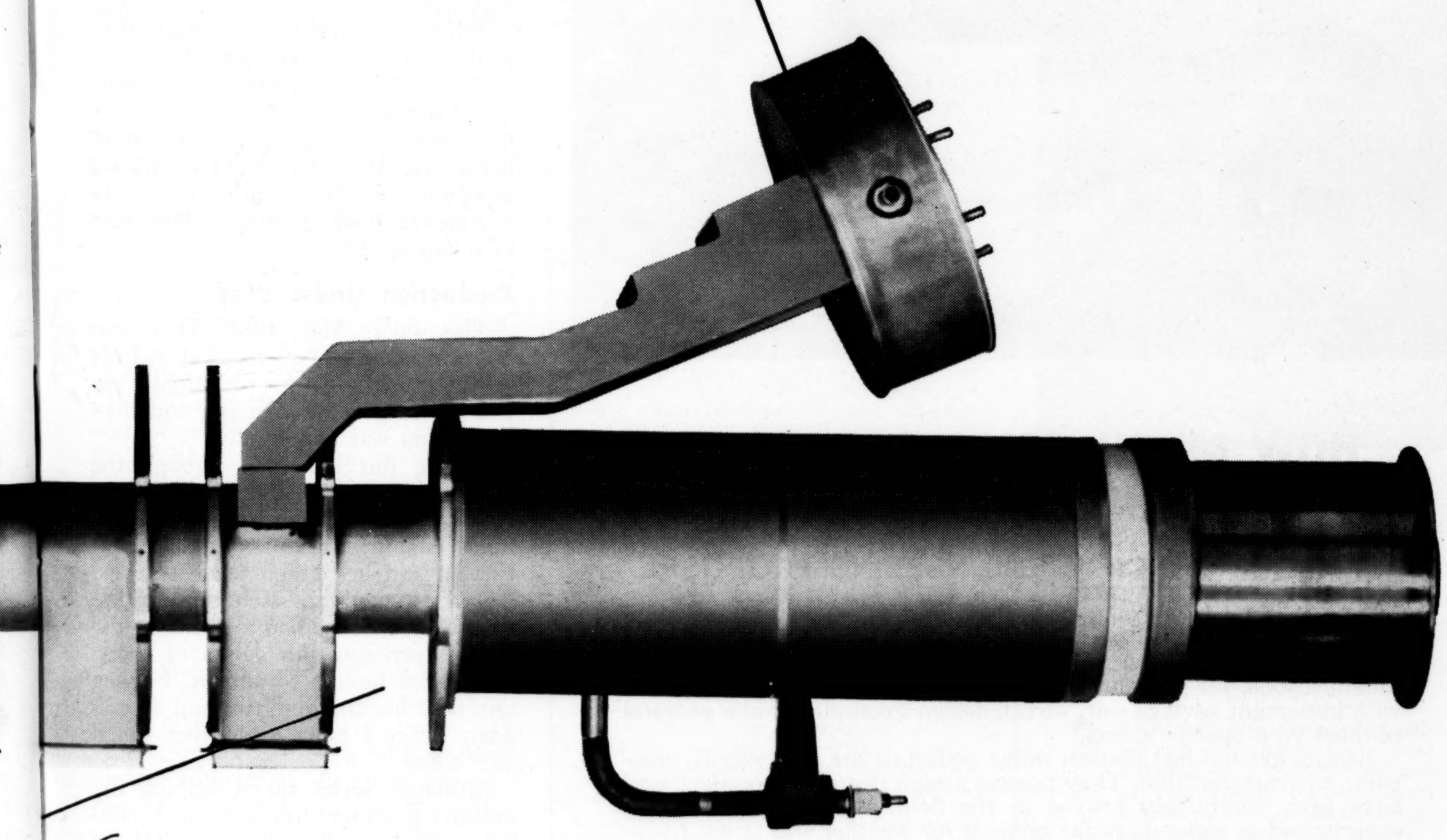

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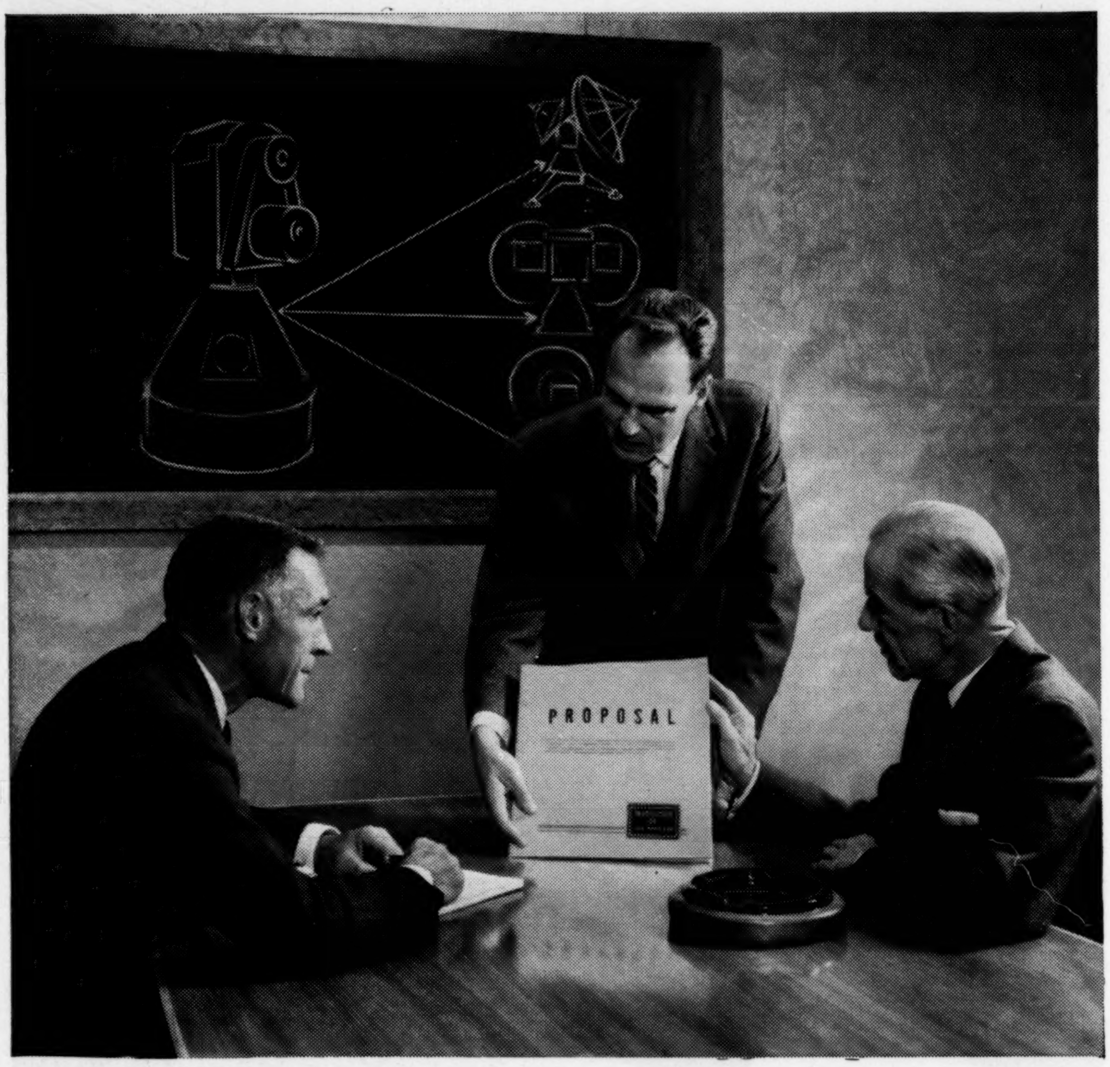

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Bendix experience in ground radar pedestal design, manufacture and installation can benefit *you*. It can meet your requirements without delay. Since basic design and tooling have already been accomplished, modifications, for your prototype needs, can be made quickly—and with important savings—or, we can design a completely new pedestal to meet your specific needs.

Bendix ground-installation radar pedestals are lightweight, compact, air transportable. They possess a high degree of accuracy, and have been completely proved in the field. Bendix also is widely experienced in airborne radar systems for weather and target tracking purposes.

If these demonstrated radar capabilities meet your needs, write today for further information, including a *specific engineering proposal*. What are your requirements?

EXAMPLES OF APPLICATIONS:
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Eclipse-Pioneer Division
Teterboro, N. J.
THE Bendix CORPORATION

District Offices: Burbank, and San Francisco, Calif.; Seattle, Wash.; Dayton, Ohio; and Washington, D.C.
Export Sales & Service: Bendix International, 205 E. 42nd St., New York 17, N. Y.

while still in Podberesje and brought the preliminary plans with him upon his return to East Germany with instructions to help revive the industry there on a rush basis. He was told at first that the new government aircraft plant for airframe design and development would have to be located at Pirna if at all possible, but he rejected the proposal on the basis that mountains in the close proximity of the area would provide added hazards to any prototype flight test operations.

He suggested Dessau as an alternative where the old Junkers runway was still available but was told that this would be impossible, with the government citing two reasons for its answer—one, the site could be observed from aircraft flying over one of the three Western air corridors into Berlin and, two, the residents of Dessau had played a major role in the June, 1953 anti-Communist uprising. Allusion to the latter was taken by Freytag to mean that, as dissidents, Dessau was not to be rewarded by the appearance of a large new plant there.

The government then said flatly that, if Pirna was not acceptable, the plant had to be located in the Dresden area, and Freytag visited a Soviet military base there that was in the process of being evacuated. He said the site was acceptable but, first of all, "I must have a concrete landing strip." The East Germans agreed.

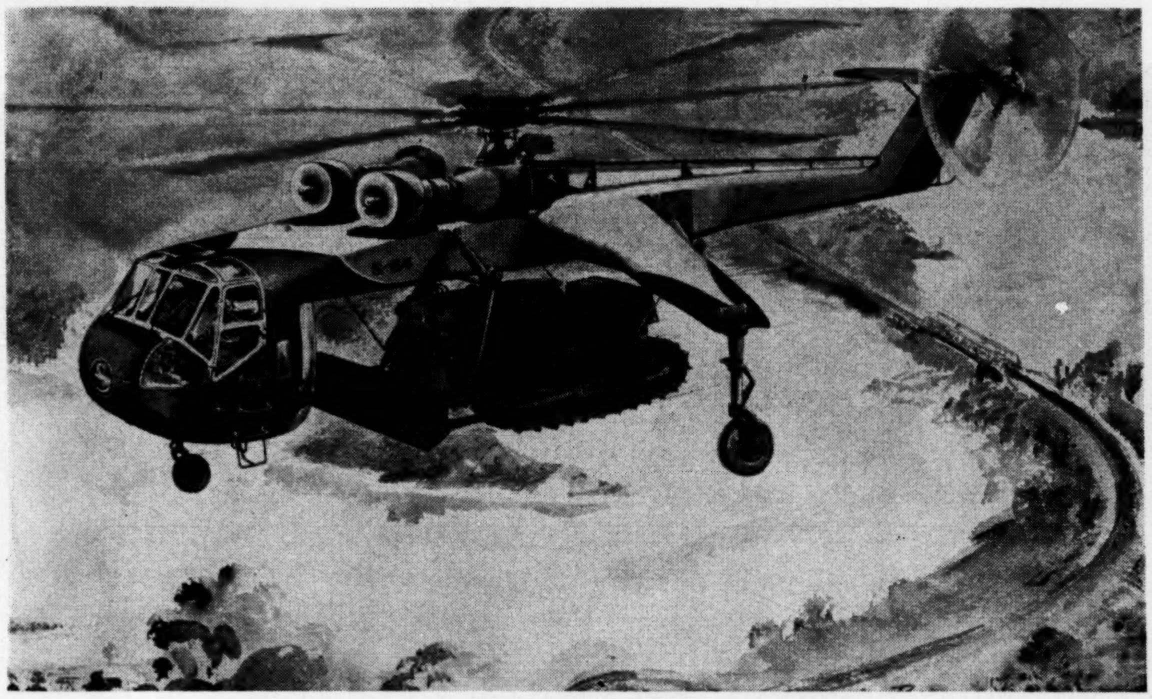
Production Under Way

This was in May, 1955. There was no runway and no facilities, but by early 1957 the first metal for the initial Type 152 prototype was being cut, and Il-14 production was under way.

During this time and through the follow-on designs for the Type 152, the East German government funneled in funds almost without question, but Freytag and his design team were expected to produce. Referring to the amount of time he had to spend at the plant supervising the design of everything from tooling to aircraft, Freytag says now his children saw him so seldom, "when I came home, they called me 'Uncle.'"

Although Soviet aid in helping the industry to its feet has been much publicized, and the Russians haven't been averse to accepting the credit, almost all the equipment at Dresden was German-built and German-designed, according to Freytag, although some was purchased directly from the West. "My best piece," Freytag says, "was an English-built milling machine."

Dresden itself was designed and built as an entity within itself with its own research and development laboratories for standard equipment, electronics, hydraulics and static testing. German-designed and -built equipment included a high-speed Mach 1.4 suction-type



Sikorsky S-64 Skycrane Proposal

Proposed Sikorsky S-64 twin-turbine Skycrane, shown above in artist's conception, will use detachable pods to convert quickly for various missions, including troop and cargo transport, missile mobility, field hospital work, communications centers, ASW, mine countermeasures and fleet utility and towing. Helicopter will be powered by two Pratt & Whitney JFTD12A-2 gas turbines producing total of 6,400 normal rated shp. at sea level.

wind tunnel driven by a jet engine; a low-speed tunnel for accelerations of up to 230 fps.; a large unit for testing landing gear strength and resistance with a maximum dropping weight of 66 U. S. tons, and a test room for hydraulic and electronic systems with controllable temperatures ranging between −70C and +120C.

The electronic test room dimensions were 13 ft. high, 13 ft. wide and 20 ft. long.

Essentially, Dresden designed the units—from valves to tail plane—and then either built them in-house or farmed them out to other plants such as Karl-Marx-Stadt.

During their eight years in Russia, Freytag—a technician making important contributions to the state—and his family say they managed to live relatively well.

In Dresden, where Freytag was a leading citizen, he and his family lived much better.

A seven-room house with a large garden was put at their disposal, and they enjoyed the use of two automobiles, including one large American-made machine.

Leaving this behind was one of the decisions Freytag had to make as he left the East for the West.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by U. S. Air Force contracting offices:

HEADQUARTERS, WARNER ROBINS AIR MATERIEL AREA, USAF, Robins AFB, Ga.

Lockheed Aircraft Corp., Marietta, Ga., spare parts in support of C-130 aircraft (RFP-61-2605), $421,665.

Marlin-Rockwell Corp., Jamestown, N. Y. Bearings applicable to supercharger CH-7B50, B22, B31 & B33 (IFB-61-724), $30,000.

Lockheed Aircraft Corp., Marietta, Ga. Spare parts in support of C-130 aircraft (RFP-61-2760), $28,816.

A C Spark Plug Div., General Motors Corp., Milwaukee, Wisconsin. Spare parts applicable to AN/ASB-9A BNS (RFP-61-2563), $121,954.

The National Cash Register Co., Dayton, Ohio. Spare parts in support of MES BNC, AJQ-3 BNC and ASB4 BNS (RFP-61-2466), $29,370.

Dalmo-Victor Co. Div. Textron, Inc., Belmont, Calif. Spare parts in support of misc. FCS (RFP-61-2762), $112,921.

Radio Corporation of America, Camden, N. J. Spare parts applicable to ASQ 42 OWCS (RFP-61-2114), $151,752.

Gulf Coast Airmotive, Municipal Airport, Mobile, Ala. Repair/overhaul of C-47 aircraft components (IFB 61-556), $87,864.

HEADQUARTERS, AERONAUTICAL SYSTEMS DIVISION, Wright-Patterson AFB, Ohio.

Chicago Aerial Industries, Inc., Barrington, Ill., technical data for aerospace ground equipment, No. 6, dated Apr. 11, 1961, to contract AF 33(600)35509, $72,851.

International Business Machines Corp., Federal Systems Division, Rockville, Md., various quantities of components of AN/ASB-4-9-9A bombing navigational system. (Usage B-52 aircraft). Letter contract AF 33(600)-42967, dated Apr. 4, 1961, $150,000.

Boeing Co., Seattle, Wash., acquisition of facilities in support of DS-1 program. Supplemental agreement No. 16 dated Mar. 29, 1961, to contract AF 33(600)36041, $28,439.

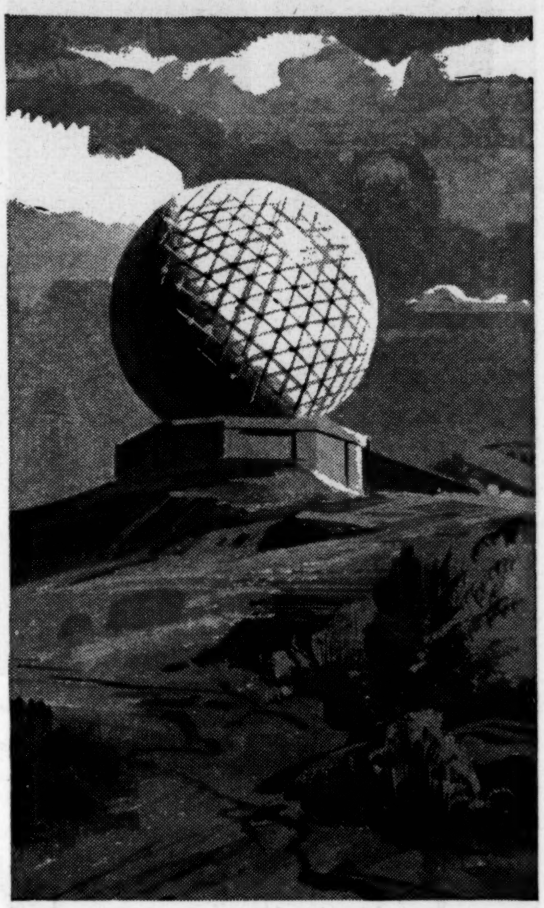
Boeing Co., Wichita, Kan., additional facilities at Air Force Plant No. 13. Supplemental agreement No. 4, dated Apr. 20, 1961, to contract AF 33(600)41399, $298,600.

Continental Aviation and Engineering Corp., Toledo, Ohio, J69-T-25 engines, data and summary bill of materials. Letter contract designated supplemental agreement No. 3, dated Apr. 6, 1961, to contract AF 33(600)42426, 69 each, $500,000.

Hazeltine Corp., Hazeltine Electronics Division, Little Neck, N. Y., Technical manuals for test equipment and ground handling equipment and data, (for radar set AN/APS-95) supplemental agreement No. 7, dated Apr. 7, 1961, to contract AF 33-(600)38428, $140,859.

ENGINEERING
REPORT
ON OTHER BENDIX
COMPONENT PACKAGES

PRECISION DATA AND CONTROL SYSTEMS FOR LARGE RADAR ANTENNAS



Through intensive research and development for major programs, Bendix offers a wealth of design experience in both digital and analog radar control and data systems. We can:

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2 Provide a wide range of installation options, i.e.: one antenna or a battery; control of one radar by another; digital or analog control. Systems with accuracies of .005° or better can be offered.

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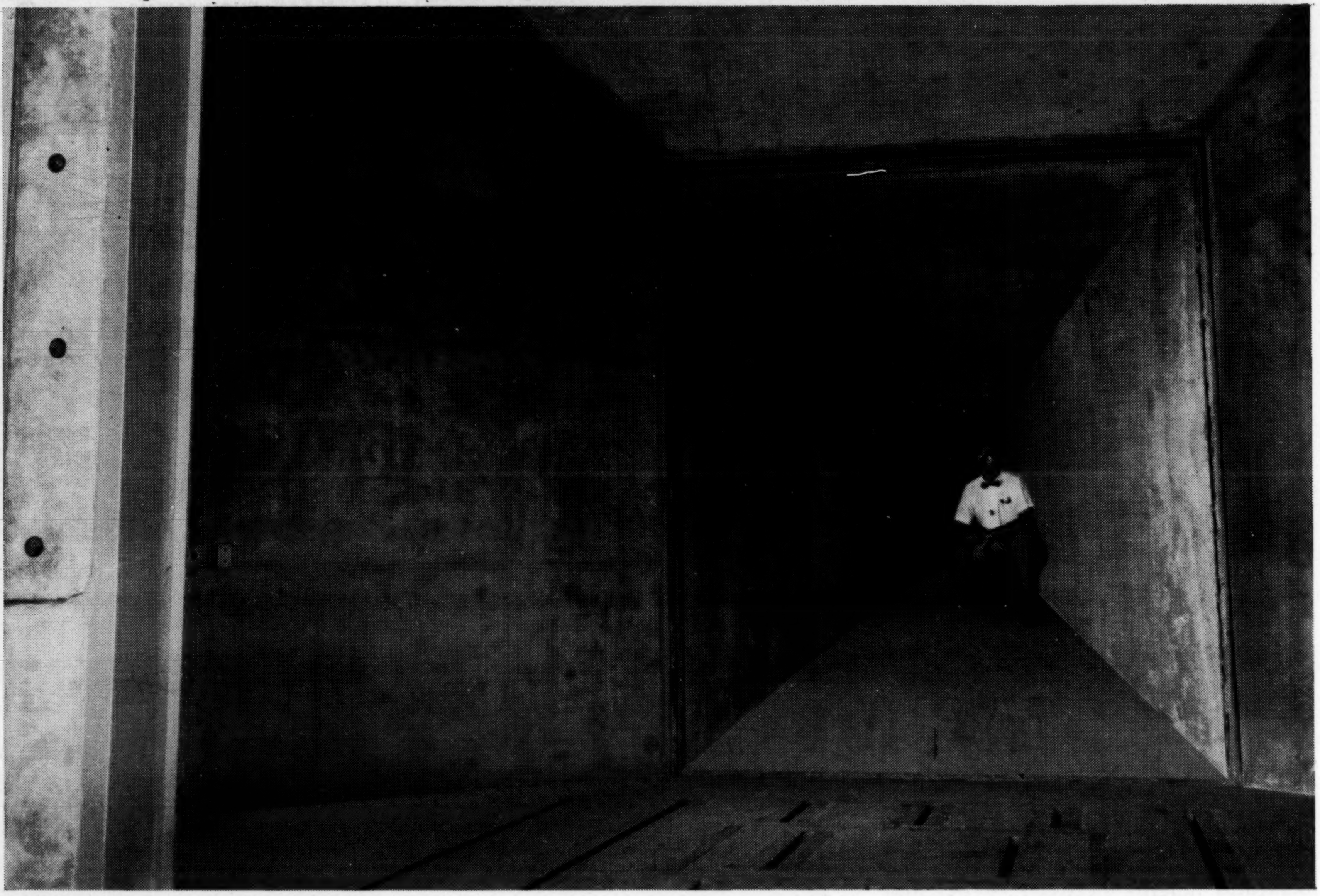
RADAR DEVICES • INSTRUMENTATION
PACKAGED COMPONENTS

Eclipse-Pioneer Division

THE Bendix CORPORATION

Teterboro, N. J.

Concrete loudspeaker horn is 47 feet x 30 feet—the largest in the world.



Mach 3
Technology

Torturing aircraft structures with the world's largest "gramaphone"

To predetermine in-flight stresses on an aircraft as advanced as the Air Force's Mach 3 B-70 Valkyrie, it was necessary to make sweeping advances in the state-of-the-art of testing procedures.

One way the Los Angeles Division of North American Aviation met this challenge was to build the largest, loudest acoustical test chamber in the world. Here, a mammoth 47 foot by 30 foot concrete loudspeaker horn can blast aircraft structural specimens with up to 170 decibels of noise. This is the equivalent of 54,000 five-tube radios going full blast, yet ingenious soundproofing keeps this noise to no more than a discreet whisper outside the lab. The noise inside the lab is so great that the heat generated could ignite fiber glass insulating material.

Specimens up to 6 feet by 25 feet can be tested in the acoustical lab. It has the capacity for: progressive wave as well as reverberant sound fields; grazing or normal incidence specimen orientation; discrete frequency or random noise at sound levels up to 170 dbs; thermal environment testing from −100°F to +1200°F; frequencies of 50 to 10,000 cycles per second. This is indeed a remarkable facility for acoustical testing, fatigue testing, and vibration testing.

This giant acoustical laboratory can not only carry out testing on tomorrow's Mach 3 aircraft, but can perform tests on aerospace craft still ten years from reality. The lab is only one of the many that the Los Angeles Division has developed to conquer problems of space age flight.

Builders of the B-70 Valkyrie

THE LOS ANGELES DIVISION OF **NORTH AMERICAN AVIATION**

Callery Chemical Co., Pittsburgh, Pa., repair of damage to government property, supplemental agreement No. 6, dated Apr. 14, 1961, to contract AF 33(600)-41757, $88,731.

Andrea Radio Corp., Long Island City, N. Y., AN/AIC-18 intercommunication equipment, maintenance spare parts, supplemental agreement No. 3, dated Apr. 17, 1961, to contract AF 33(600)-42518, 226 ea., $89,090.

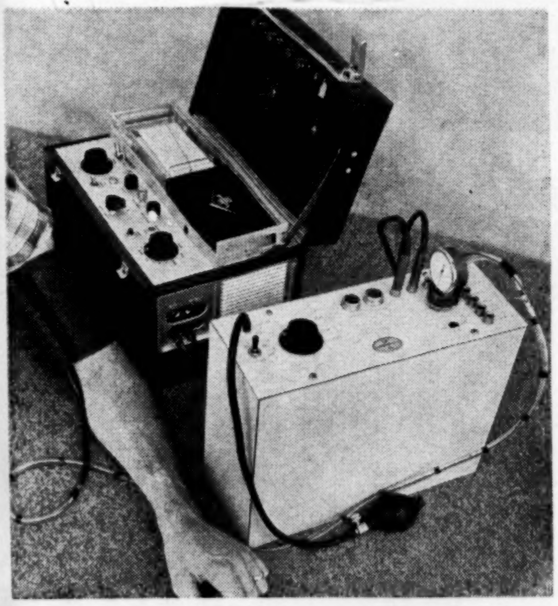
General Precision, Inc., Kearfott Division, Little Falls, N. J., qualification and life testing of components of AN/AJN-8, applicable to B-52 aircraft, contract AF 33-(600)-42836, dated Mar. 16, 1961, $753,922.

Aeroflex Laboratories Division, The Aeroflex Corp., Long Island City, N. Y., spare parts for aerial camera mounts, contract AF 33(600)-42874, dated Apr. 25, 1961, 890 ea., $65,172.

Collins Radio Co., Cedar Rapids, Iowa, transmitter, radio type 17L-7A(AC), aerno 81-9322, 39 ea., transmitter, radio type 17L-7A(DC), aerno 81-9321, 203 ea., receiver, radio type 51X-2B(AC), aerno 81-8096, 38 ea., receiver, radio type 51X-2B(DC), aerno 81-8090, 183 ea., control radio type 614U-6, aerno 81-2291, 221 ea., mount shock type 390E-2, aerno 81-4474, 22 ea., instrumentation unit type 344B-1, aerno 81-3353, 2 ea., IFR-Audio module, part of receiver 51X-2B, 40 ea., amplifier RF-IFR module, part of receiver 51X-2B, 40 ea., d.c. power supply 516B-3, part of receiver 51X-2B, 40 ea., filter passive, part of receiver 51X-2B, 40 ea., d.c. power supply 516D-1, part of transmitter 17L-7A, 40 ea., modulator RF, part of transmitter 17L-7A, 40 ea., RF module, part of transmitter 17-7A, 40 ea., antenna, type 37R2, 1 ea. spare parts, ground support equipment and data, contract AF 33(600)-42915, dated March 20, 1961, $1,045,223.

SAN ANTONIO RESEARCH AND DEVELOPMENT PROCUREMENT OFFICE, AERONAUTICAL SYSTEMS DIVISION (AFSC), Box 63, Lackland AFB, Tex.

Aero-Space Division, Boeing Co., Seattle, Wash., research and reports on a concentrated activated sludge process for closed-system waste treatment. Contract AF 41 (657)-387), job $37,337.



Blood Pressure System

Automatic blood pressure measuring system, developed by Garrett Corp.'s AiResearch Mfg. Co., will monitor astronaut's blood pressure during forthcoming Mercury orbital flights. Unit consists of cuff containing sensing device and a transducer which will accept and filter sensed electrical signals. Cuff will be inflated periodically during flight, blood pressure taken, and results recorded or telemetered. System was purchased by McDonnell Aircraft Corp. for use in Mercury capsules.

ABOARD A RADAR PICKET PLANE

. . . a new Eastern cooling system helps to keep the Philco APS-103 search radar on the lookout for bogies and bandits. The liquid cooling unit has a capacity of 1600 watts, but weighs only 15 lbs., and fits into a compact 5-9/32" x 9-7/8" x 7-7/8" volume. Designed for operation to 50,000 feet, it features an ingenious internal manifold which makes for simplicity, reliability, and which eliminates most internal connections. If you need efficient, miniaturized light weight cooling units for airborne electronics cooling, call on Eastern. Eastern is your perfect source for liquid tube cooling units for capacities from 50 to 20,000 watts.

Eastern Aviation Products

EASTERN INDUSTRIES
100 Skiff Street, Hamden 14, Conn.

West Coast Office:
4203 Spencer St.,
Torrance, Calif.

PROBLEMATICAL RECREATIONS **80**

EXPENSE ACCOUNT

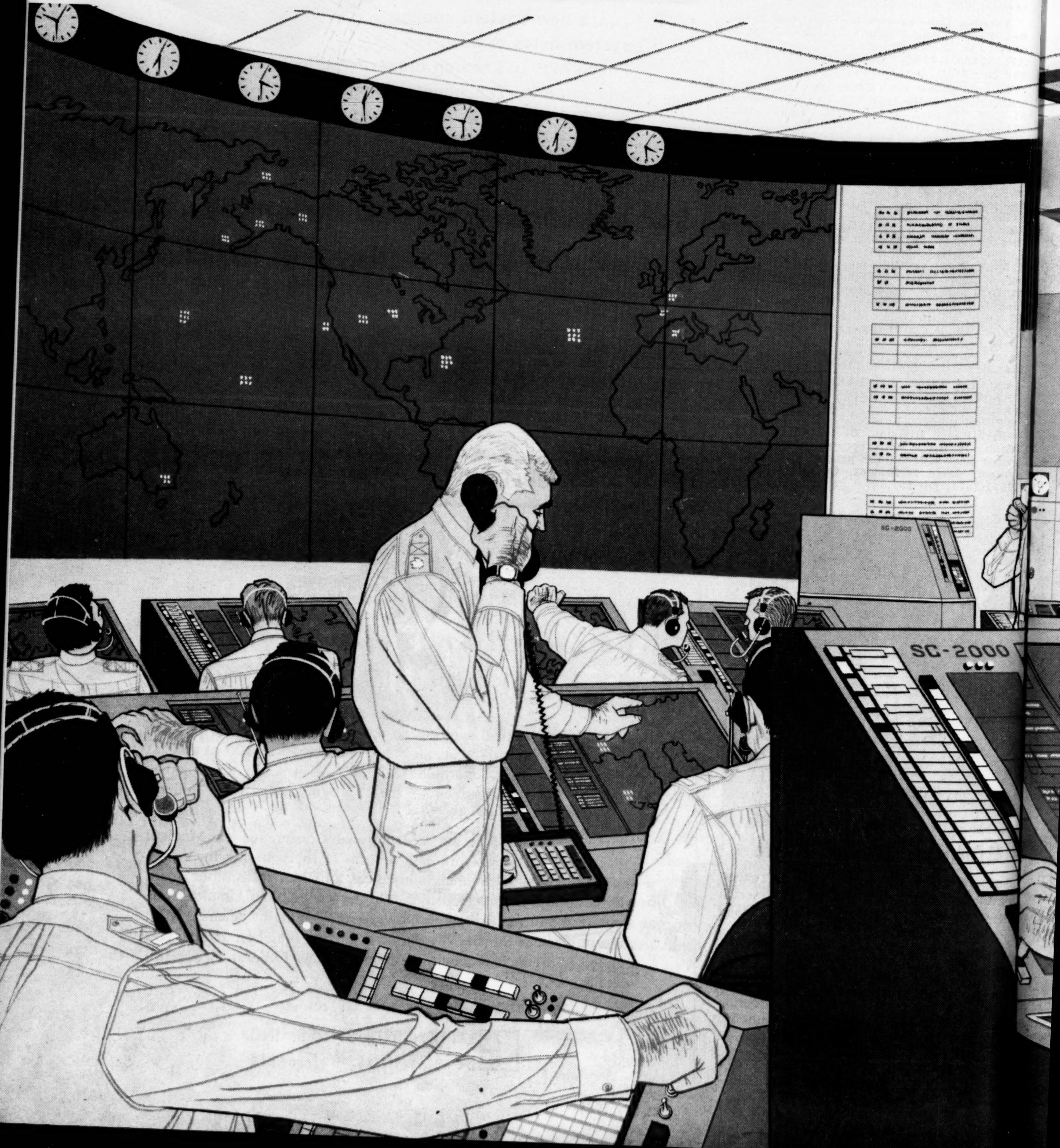
Using mathematical symbols to modify four fours it is possible to make equations for all the numbers from 0 to 100 as well as millions of others. Example: 2 = 4/4 + 4/4. In this manner arrange four fours to equal these progressively more difficult numbers: 13, 19, 33, 85. *—Contributed*

Perhaps you were at the International Conference on Medical Electronics in New York last month. If so, you saw the Multipack, the new 3-channel biomedical amplifier-transmitter from our Litton Systems Division that makes possible simultaneous remote monitoring of three bioelectrical signals by telemetry, all in a unit about the size of a box of kitchen matches. If not, you missed it. Better call our Computer Systems Laboratory for full details.

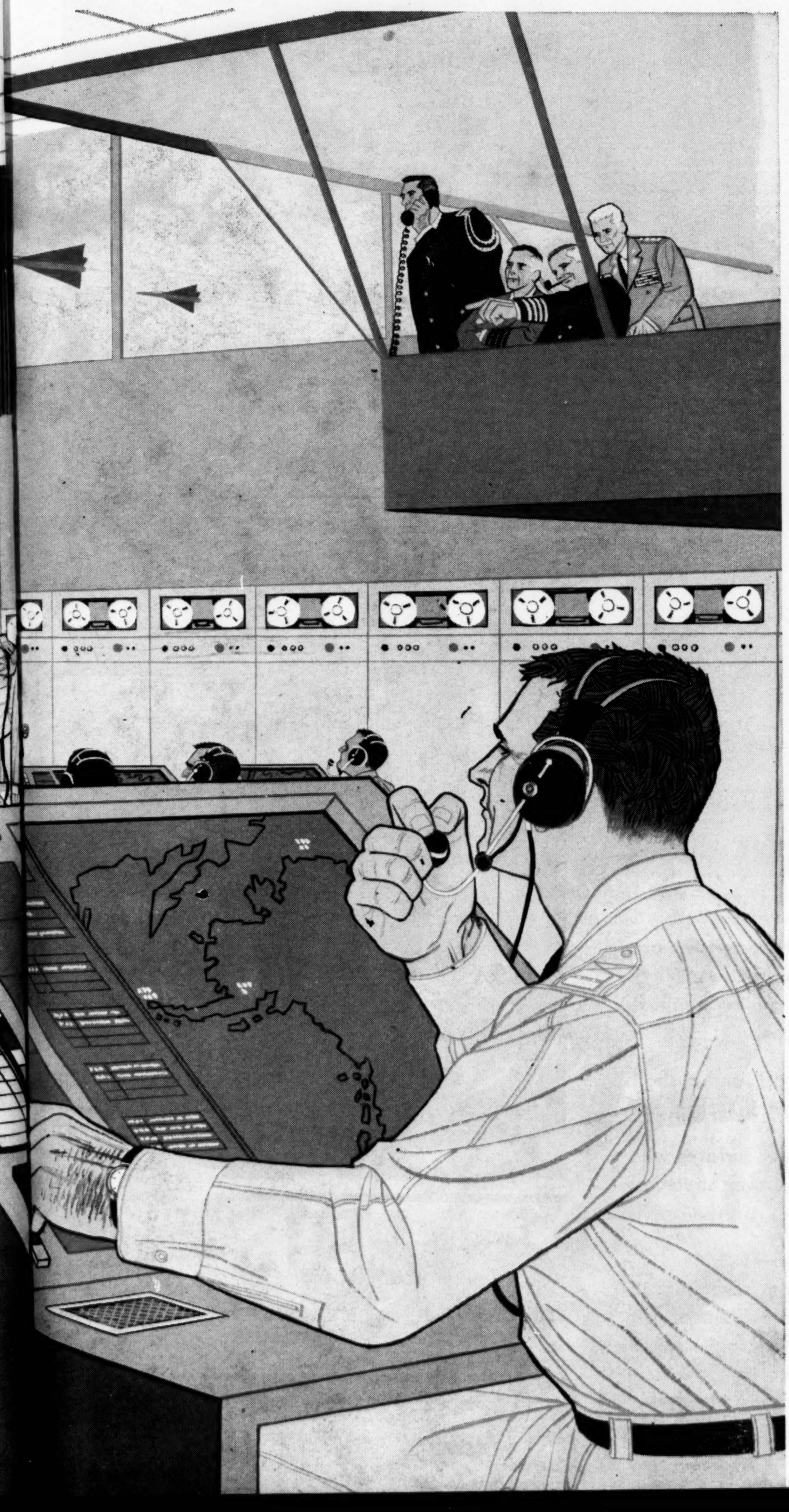
ANSWER TO LAST WEEK'S PROBLEM: 25 feet.

LITTON INDUSTRIES, INC.
Beverly Hills, California

Less than 2 seconds from computer to larg


SC-2000
SC-2000

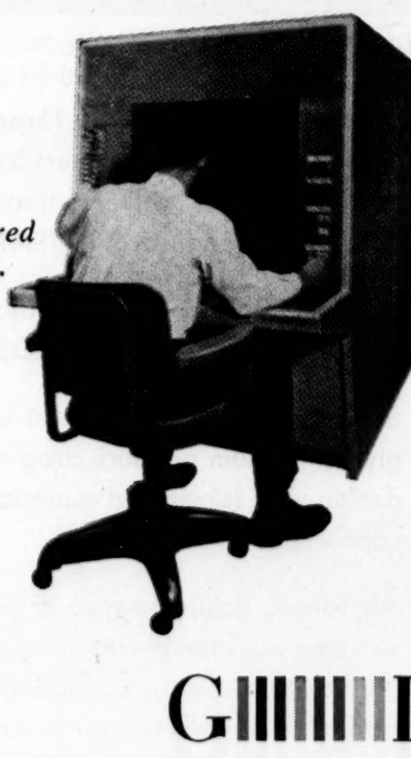
rg creen display WITHOUT DARKENING THE ROOM!



The new, advanced S-C 2000 bright display system developed by General Dynamics/ Electronics produces an entire large screen display less than two seconds after data are transmitted from the computer. The unique yet simple principle of the S-C 2000 results in high-contrast storage displays with unsurpassed brightness and resolution for information presentation on both console and large screens.

The S-C 2000 will display both video and alphanumeric data of all kinds simultaneously with any type of overlay. Display information need be transmitted only once from the data source owing to the inherent storage capability of the S-C 2000. The unit also provides both fail-safe retention of data and various types of permanent hard copy. Completely dry processing is incorporated with data rates of 40,000 separate characters per second. Scale changing, category commands and display selection are accomplished at the control console, without interrupting the computer.

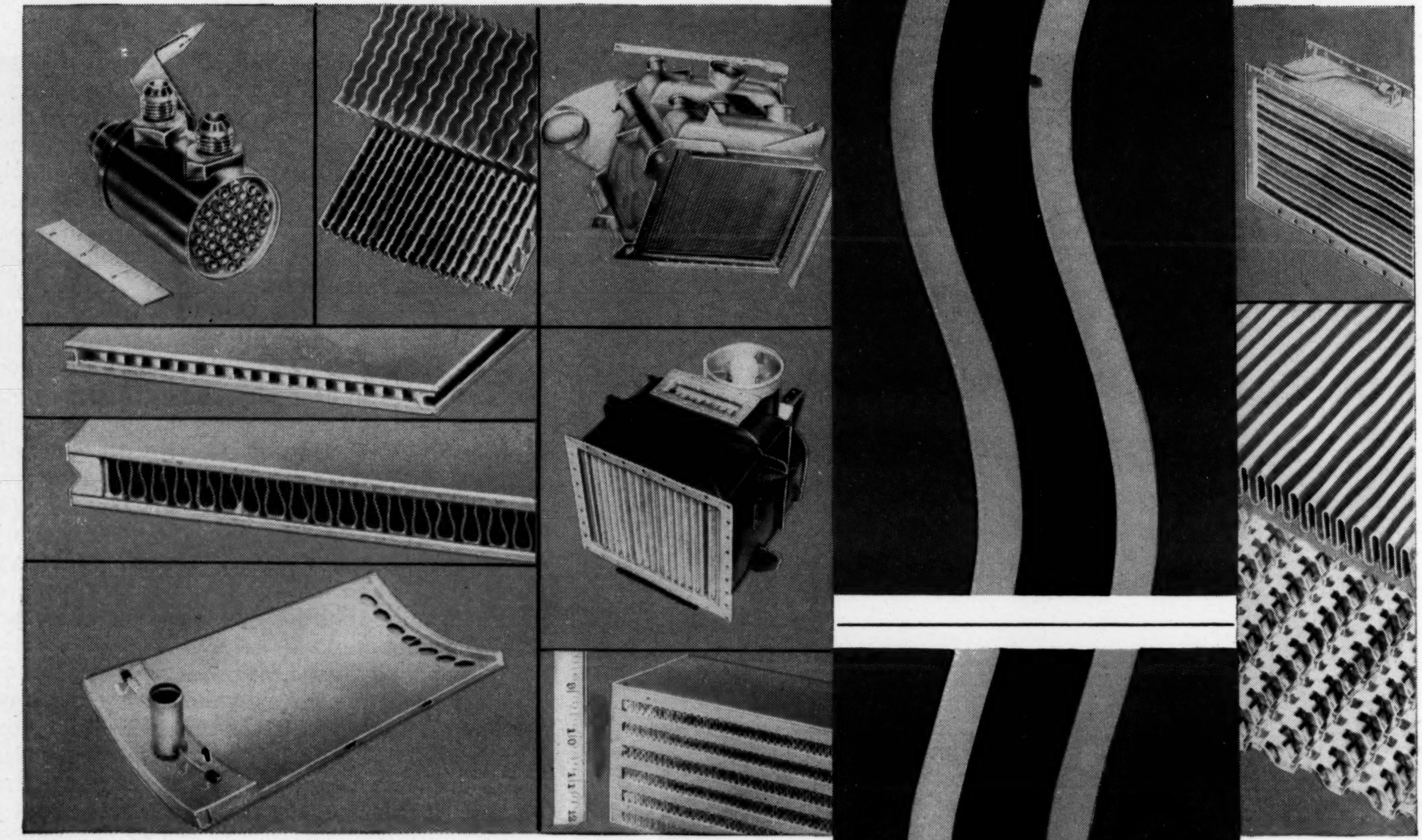
A capability exists for seven color displays or data may be viewed as white against black or black against white. Resolution is 2000 lines on each axis. The S-C 2000 was developed under the auspices of the U. S. Air Force and Mitre Corp. If your requirements include computer display systems, we invite you to write for more information on the S-C 2000, a product of the company that produced the display control center for Project Mercury, General Dynamics/ Electronics, Information Technology Division, Dept. B-48, Box 2449, San Diego 12, California, or contact the representative in your area.



The first developmental S-C 2000 console delivered to Mitre Corp.

GD

GENERAL DYNAMICS | ELECTRONICS



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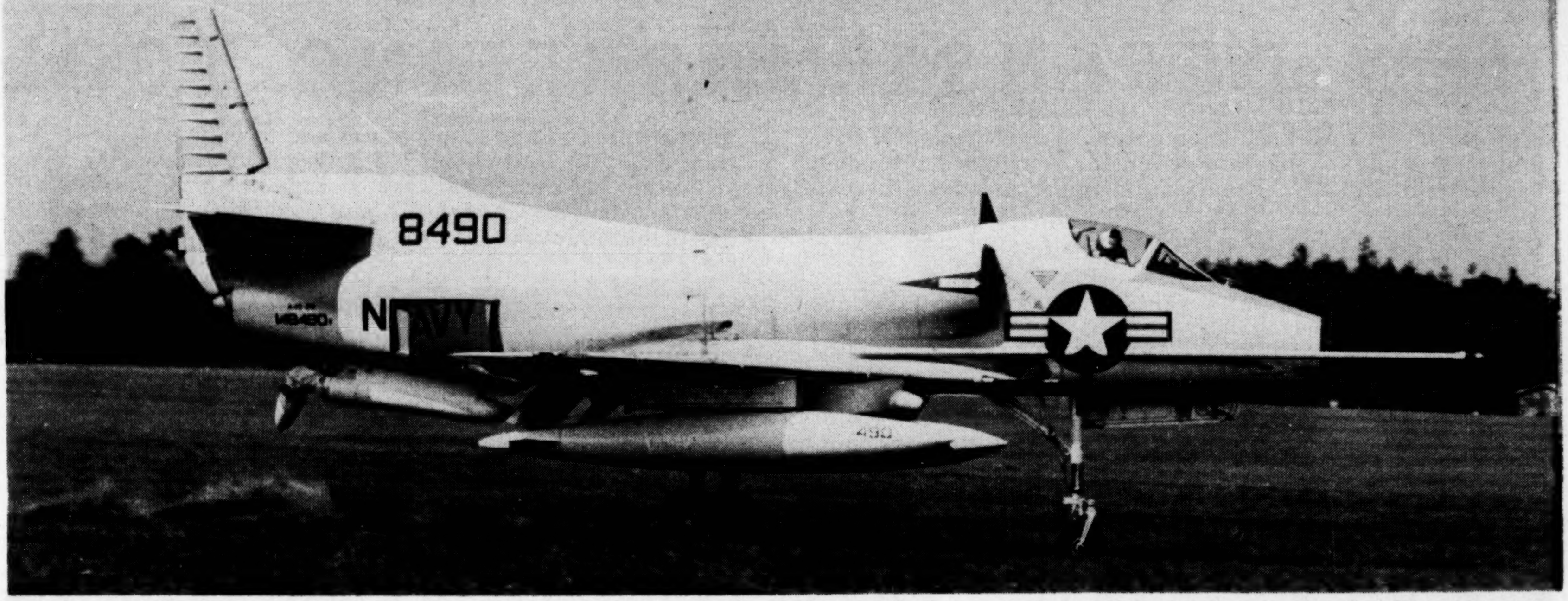
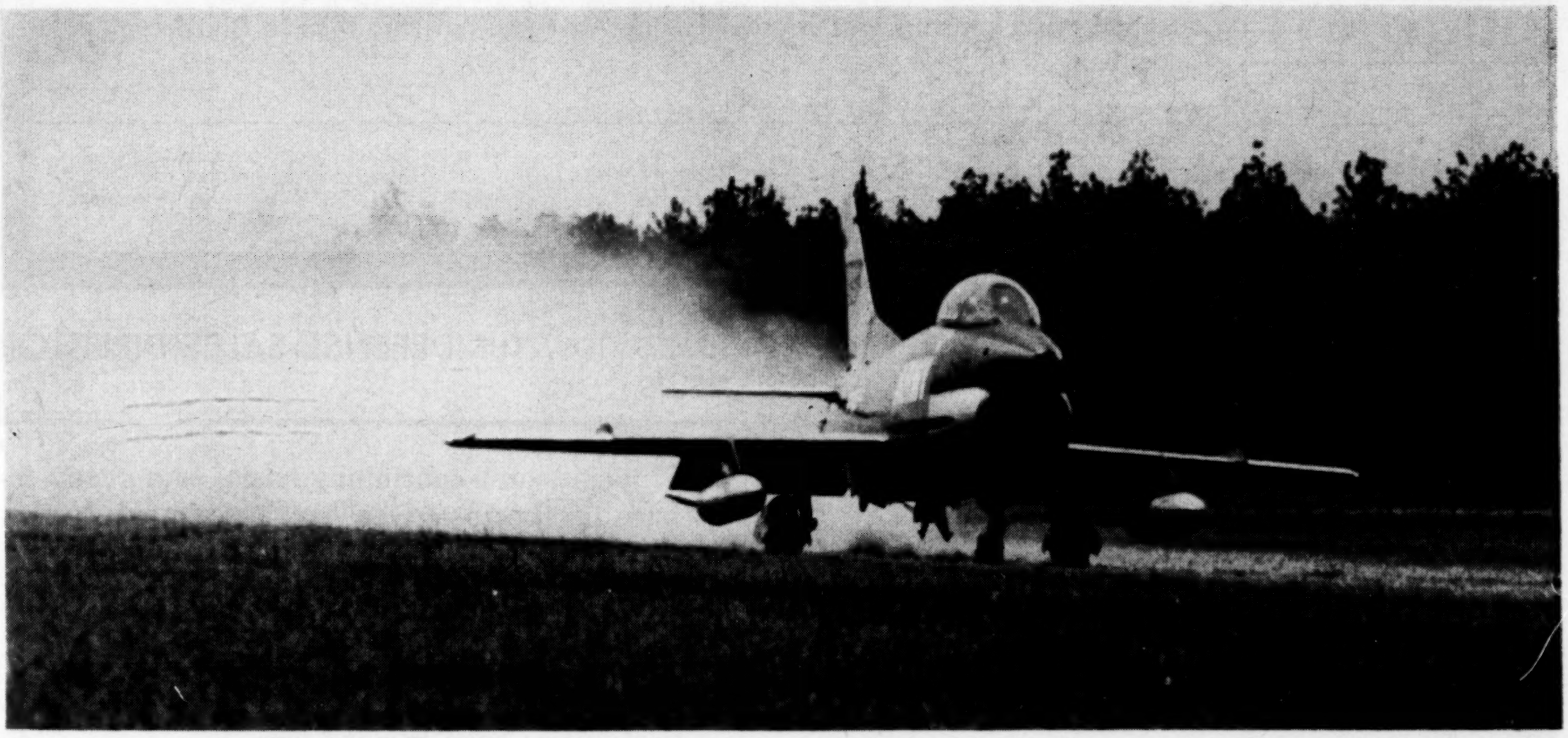
BAY SHORE, L.I., N.Y.

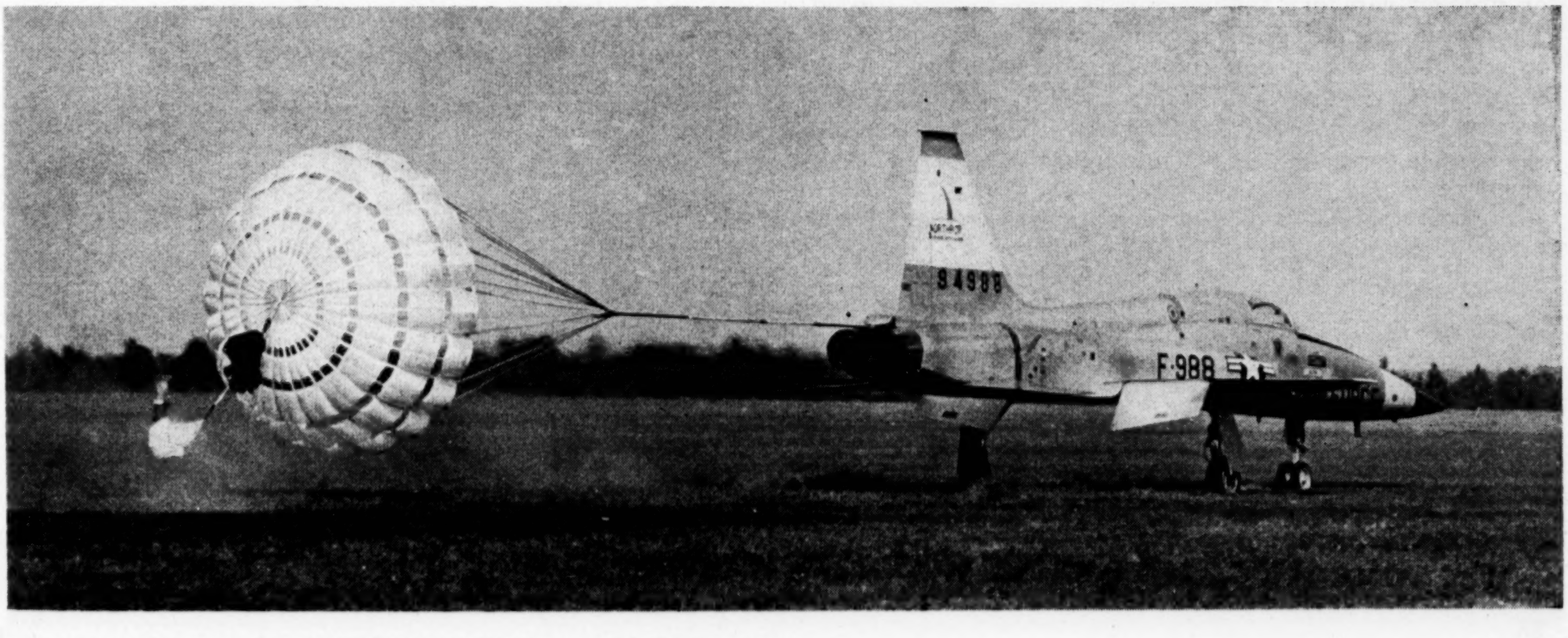


Douglas A4D lands in sod field with drag chute beginning to deploy and speed brakes extended. U. S. Army completed a 9½ week evaluation of three aircraft which are candidates to serve as an interim tactical fighter until a projected V/STOL tactical fighter with transatlantic ferry range is developed. Composition of the team and the appearance of the Italian Fiat G.91 (middle photo) in U. S. Army markings raises the question of whether the interim fighter is to be operated by USAF Tactical Air Command or the Army.

Tactical Aircraft Evaluated for Interim Fighter Role



One of the two Italian Fiat G.91 strike fighters at the trial throws up a cloud of dust as it adds power for takeoff from Navy's auxiliary field at Pensacola, Fla. Northrop N-156 (below) with drag chute deployed lands at sod field during trials.



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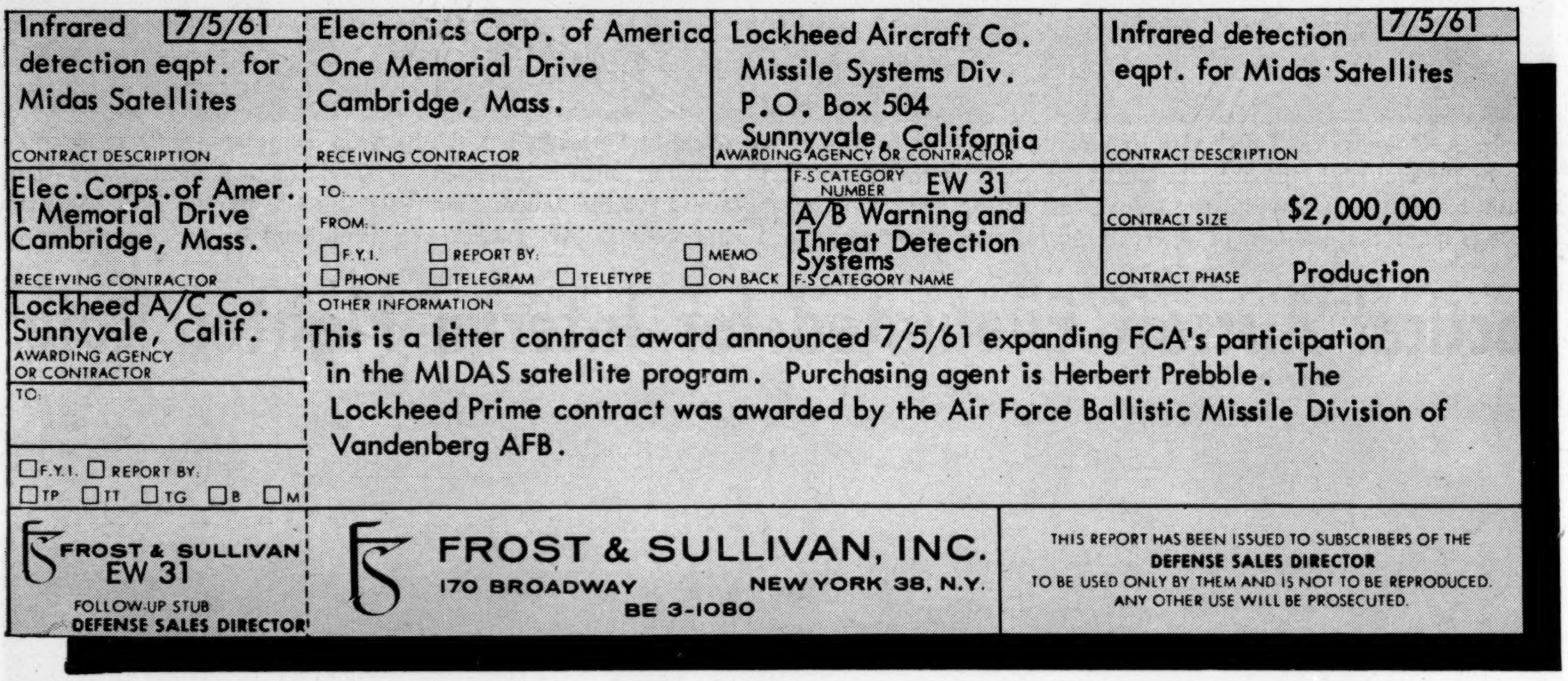
Now you can actually follow the daily-changing defense industry market. You can know which of the many companies comprising your market are ready-to-buy, because they have the money to buy and the requirement for your product.

The DEFENSE SALES DIRECTOR is designed to give you complete and timely information on your specific selling opportunities—and it is tailor-made to your specific selling requirements. Gathering full information about your ever-changing market is always costly, often impossible. It means night work for you, many trade reports to read, and frequent blind and unproductive calls by your salesmen.

The DEFENSE SALES DIRECTOR supplies *in one service* your intelligence requirements. And the information is supplied at the *Time* you need it—the time your selling opportunities exist. If it is important that you have this type of information, the DEFENSE SALES DIRECTOR is important to your sales effort.



Infrared detection eqpt. for Midas Satellites 7/5/61
CONTRACT DESCRIPTION

Electronics Corp. of America
One Memorial Drive
Cambridge, Mass.
RECEIVING CONTRACTOR

Lockheed Aircraft Co.
Missile Systems Div.
P.O. Box 504
Sunnyvale, California
AWARDING AGENCY OR CONTRACTOR

Infrared detection eqpt. for Midas Satellites 7/5/61
CONTRACT DESCRIPTION

Elec.Corps.of Amer.
1 Memorial Drive
Cambridge, Mass.
RECEIVING CONTRACTOR

TO: ....
FROM: ....
☐ F.Y.I. ☐ REPORT BY: ☐ MEMO
☐ PHONE ☐ TELEGRAM ☐ TELETYPE ☐ ON BACK

F-S CATEGORY NUMBER EW 31
A/B Warning and Threat Detection Systems
F-S CATEGORY NAME

CONTRACT SIZE $2,000,000
CONTRACT PHASE Production

Lockheed A/C Co.
Sunnyvale, Calif.
AWARDING AGENCY OR CONTRACTOR
TO:
☐ F.Y.I. ☐ REPORT BY:
☐ TP ☐ TT ☐ TG ☐ B ☐ M

OTHER INFORMATION
This is a letter contract award announced 7/5/61 expanding FCA's participation in the MIDAS satellite program. Purchasing agent is Herbert Prebble. The Lockheed Prime contract was awarded by the Air Force Ballistic Missile Division of Vandenberg AFB.

FROST & SULLIVAN
EW 31
FOLLOW-UP STUB
DEFENSE SALES DIRECTOR

FROST & SULLIVAN, INC.
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BE 3-1080

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3. Furnishes, in one-tailor-made service, the opportunities open to your firm.
4. Reduces your sales lead screening time from hours to minutes—eliminates unproductive sales intelligence gathering.
5. Provides a remarkably simple sales-control and follow-up system.
6. Focuses your selling effort on what counts—sales.

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DEFENSE DATA DIVISION
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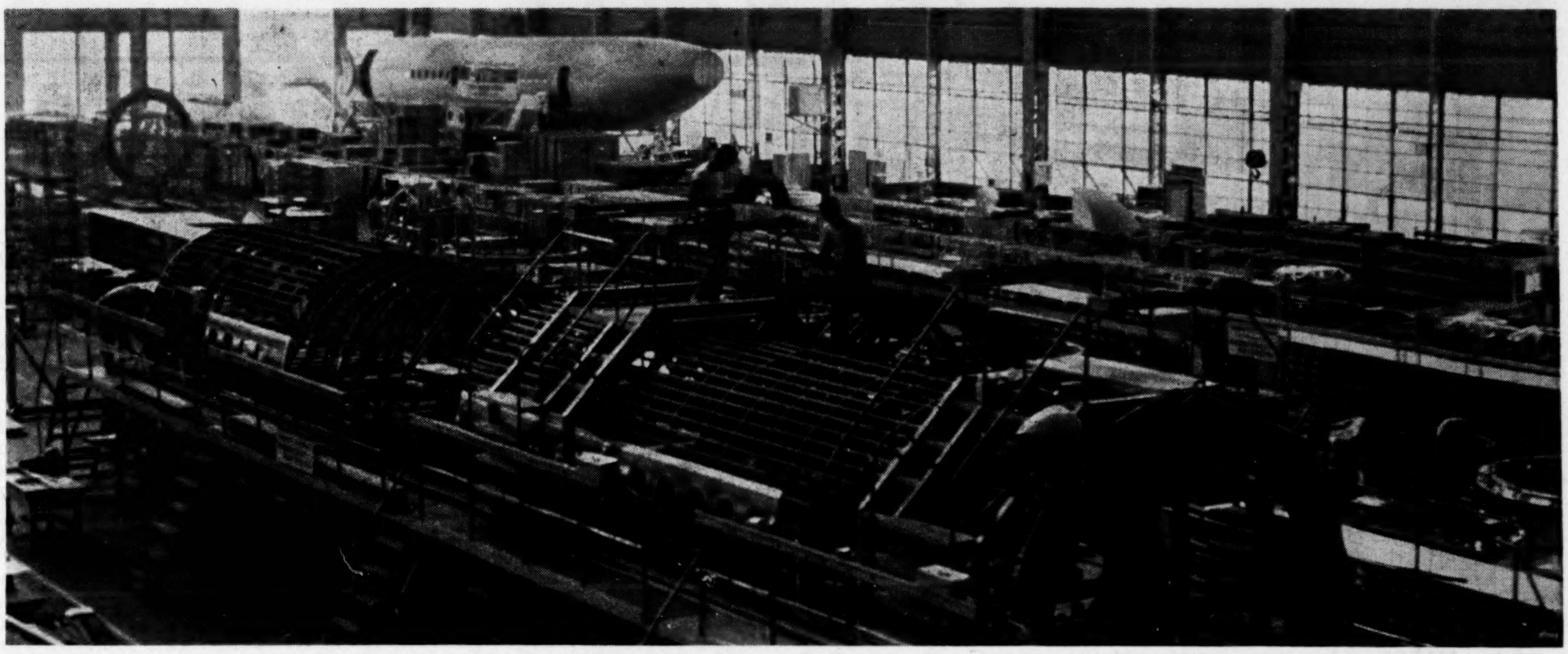
FROST & SULLIVAN, INC., Dept. 81, 170 Broadway, New York 38, N. Y.

Please send me full information on the DEFENSE SALES DIRECTOR

Name & Title..........

Company ....

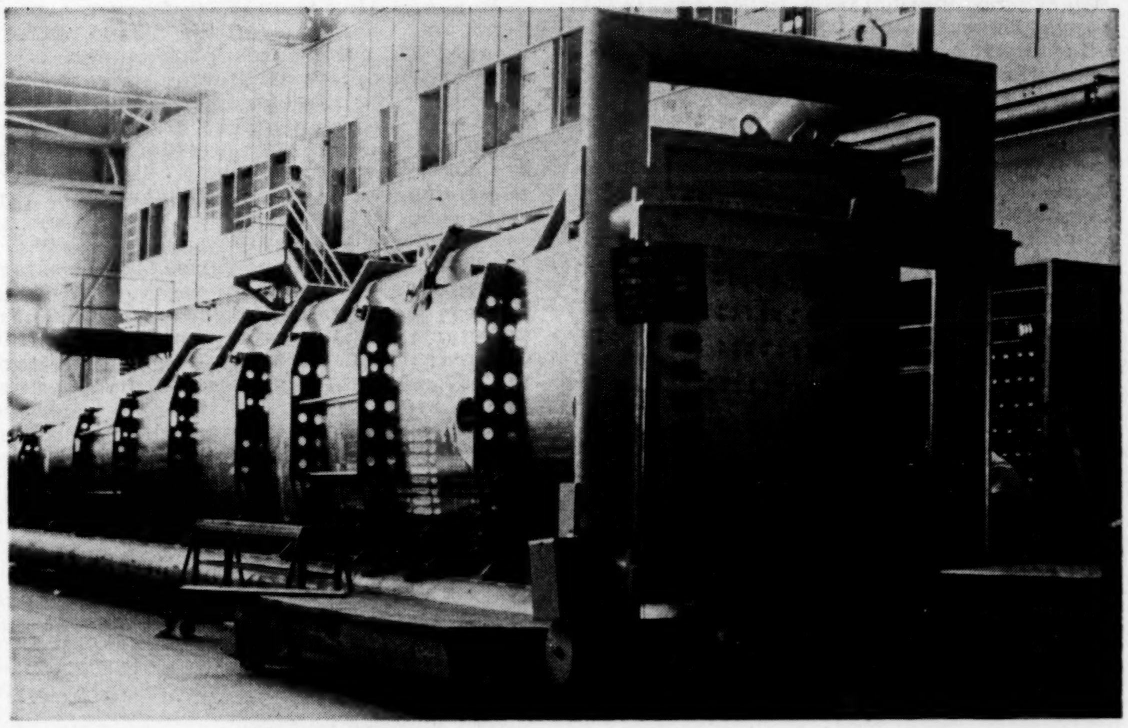
Address ....



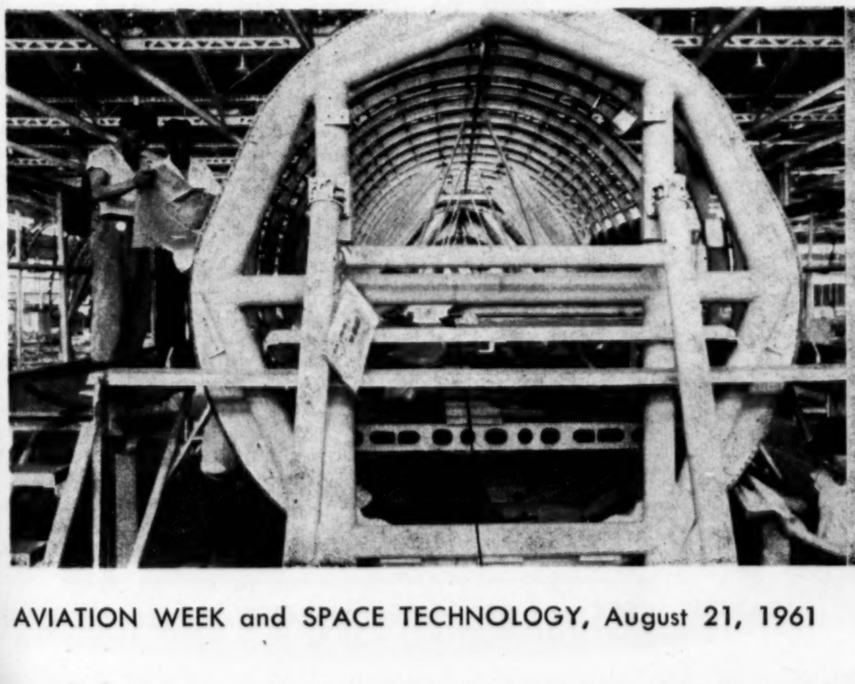
Fuselage forms begin to take shape in the Shin Mitsubishi Heavy Industries Nagoya factory as production of prototype Nihon YS-11 turboprop airliners begins. Four prototypes are scheduled for completion by summer, 1962.

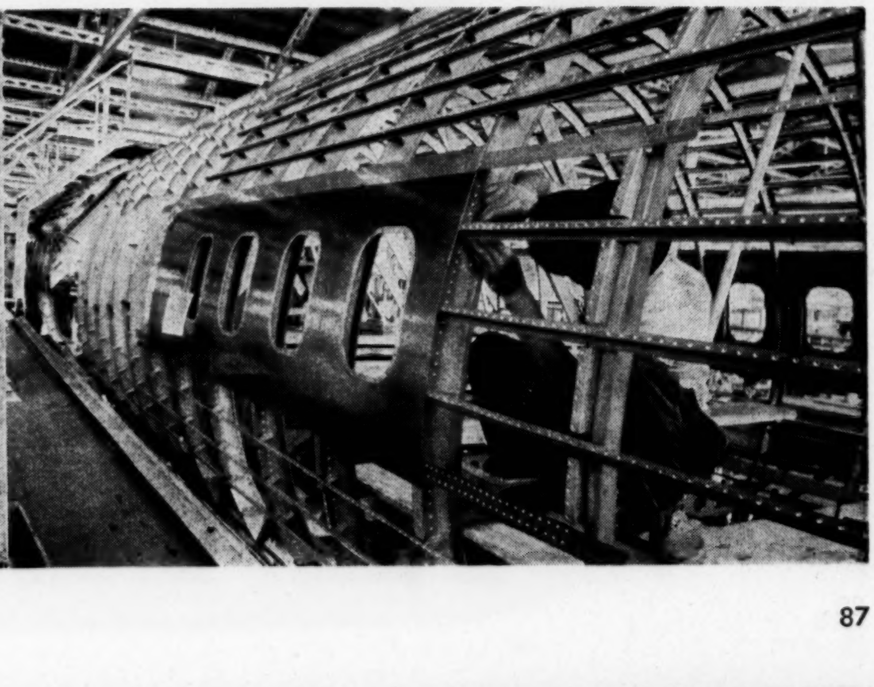
Assembly Begins on Nihon YS-11 Turboprop Transport

Final assembly of Japanese-designed YS-11 turboprop transport is under way at Nagoya plant of Shin Mitsubishi Heavy Industries. Nihon Aeroplane Manufacturing Co., Ltd., plans to have four prototype models completed by the summer of 1962 for test purposes. Nihon is a joint venture of the Japanese government and six private aircraft manufacturing companies. The aircraft, designed as a replacement for DC-3 types, will carry up to 60 passengers (AW Dec. 26, 1960, p. 60). A total of 35 now are on order from All-Nippon Airways, the Japanese Self-Defense Agency and the Japanese Maritime Safety Board. Inquiries have been received from 13 foreign nations, Nihon reported. Cost of each aircraft will be approximately $1 million, excluding seats and accessories. The company tentatively plans to produce five aircraft in 1963, 10 in 1964, 18 in 1965 and 24 yearly thereafter. Powerplants will be Rolls-Royce Dart R.Da.10/1.



Wing in jig, (above, right) will have total area of 1,020 sq. ft. and an aspect ratio of 10.8. Aircraft is designed to carry up to 60 passengers, cruise at 257 kt. at 20,000 ft. and have a maximum range of 1,290 naut. mi. with 5,400 lb. payload.





FINANCIAL

Airline Officers List Salaries With CAB

Washington—Following is a list of airline officers' salaries, bonuses and indirect compensation, expenses and stock holdings for the year ending Dec. 31, 1960, as filed with the Civil Aeronautics Board:

Allegheny Airlines—L. O. Barnes, president and director, $37,985 salary, 29,700 shares of common stock, $2,762 expenses, $3,000 debt securities; **W. J. Short**, vice president-finance, $23,237 salary, 250 shares of common stock, $1,842 expenses, $1,000 debt securities; **D. L. Miller**, senior vice president and director, $20,337 salary, 502 shares of common stock, $3,398 expenses, $2,500 debt securities; **E. I. Colodny**, vice president-legal affairs and economic research, $17,750 salary, no stock, $1,424 expenses, $1,500 debt securities; **R. G. Dinning**, vice president- flight operations, $17,220 salary, 500 shares of common stock, $1,194 in expenses and $1,000 debt securities.

N. B. Fry, Jr., vice president-sales and services (from Mar. 15, 1960), $15,833 salary, 400 shares of common stock, $1,385 expenses; **R. J. Masiello**, vice president-maintenance and engineering, $17,625 salary, no stock, $676 expenses; **G. F. Gerth**, treasurer, $11,000 salary, 200 shares of common stock, $450 expenses, $500 debt securities; **W. D. Hay**, controller, $11,000 salary, no stock, $310 expenses, $500 debt securities; **L. L. Stentzel II**, secretary (from Oct. 24, 1960), no salary, no stock, $37 expenses, $1,500 debt securities; **P. D. Brennan**, assistant secretary (from Oct. 24, 1960), $7,200 salary, 4,000 shares of common stock, $313 expenses; **V. F. Fountaine**, assistant secretary (until Aug. 5, 1960), $3,753 salary, no stock and no expenses.

N. A. Satterwhite, chairman of the board, $218 salary, 12,975 shares of common stock, $97 expenses; **G. T. Bowman**, director, no salary, 15,100 shares of common stock, no expenses, $25,000 debt securities; **R. F. George, Jr.**, director, no salary, 53,100 shares of common stock, no expenses, $85,000 debt securities; **H. O. Hale**, chief counsel and director, no salary, 1,500 shares of common stock, $47 expenses, $3,000 debt securities.

H. E. Hallowell, director, no salary, 1,000 shares of common stock, $58 expenses; **R. M. Love**, no salary, 100 shares of common stock, $233 expenses; **P. V. Mattes**, director, no salary, 5,000 shares of common stock, $52 expenses, $10,000 debt securities; **W. F. Rockwell, Jr.**, director, no salary, 15,000 shares of common stock, $65 expenses; **H. R. Sharp, Jr.**, director, no salary, 1,700 shares of common stock, no expenses; **C. F. Bidelspacher, Jr.**, director (until June 28, 1960), no salary and no stock, $24 expenses.

Following firms were paid for services rendered during 1960: **Hale, Stimson, Russell & Nickerson**, legal, $92,942; **R. Dixon Speas Associates**, technical and engineering services, $16,000; **Van Sant Dugdale & Co.**, advertising, $405,226; **Peat, Marwick, Mitchell & Co.**, audit, $9,689; **Airline Architectural Consultants**, professional services, $10,675; **Purcell & Nelson**, legal, $21,896; **Milbank, Tweed, Hope & Hadley**, legal, $11,247; **United Research, Inc.**, professional services, $21,847; **Napier Engines, Inc.**, technical services, $12,181.

Bonanza Air Lines—E. C. Converse, president and chairman of the board, $20,000 salary, 212,261 shares of common stock, $941 expenses; **G. R. Henry**, executive vice president and director, $19,000 salary, 250 shares of common stock, $2,021 expenses; **M. W. Reynolds**, vice president-operations, $18,500 salary, no stock, $1,027 expenses; **R. J. Sherer**, vice president-finance and treasurer, $14,000 salary, 900 shares of common stock, $2,719 expenses; **W. J. Mitchell**, vice president-sales, $15,381 salary, 100 shares of common stock, $3,849 expenses; **R. O. Hawkins**, general counsel and secretary, $13,377 salary, no stock, $1,742 expenses; **E. E. Jochim**, assistant secretary, $12,167 salary, 100 shares of common stock, $1,529 expenses.

T. J. Van Bogart, comptroller and assistant secretary, $10,625 salary, no stock, $200 expenses; **W. C. Burt**, assistant secretary, no salary, 1,400 shares of common stock, no expenses; **F. W. Beer**, director, $400 salary, 6,180 shares of common stock, no expenses; **R. Converse**, director, no salary, 16,500 shares of common stock, $56 expenses; **C. M. Glass, Jr.**, director, $500 salary, 1,000 shares of common stock, no expenses.

J. O. Moyle, director, $500 salary, 1,000 shares of common stock, $465 expenses; **W. D. Pabst**, director, $300 salary, 1,000 shares of common stock, no expenses; **G. L. Vargas**, director, $500 salary, 8,770 shares of common stock, no expenses; **W. T. Waggoner, Jr.**, director, $100 salary, 33,943 shares of common stock, no expenses.

Following firms were paid for services rendered during 1960: **Koteen & Burt**, legal, $28,448; **A. F. Grisard**, legal, $10,618; **Vargas, Dillon & Bartlett**, legal, $8,157; **Peat, Marwick, Mitchell & Co.**, audit, $7,063.

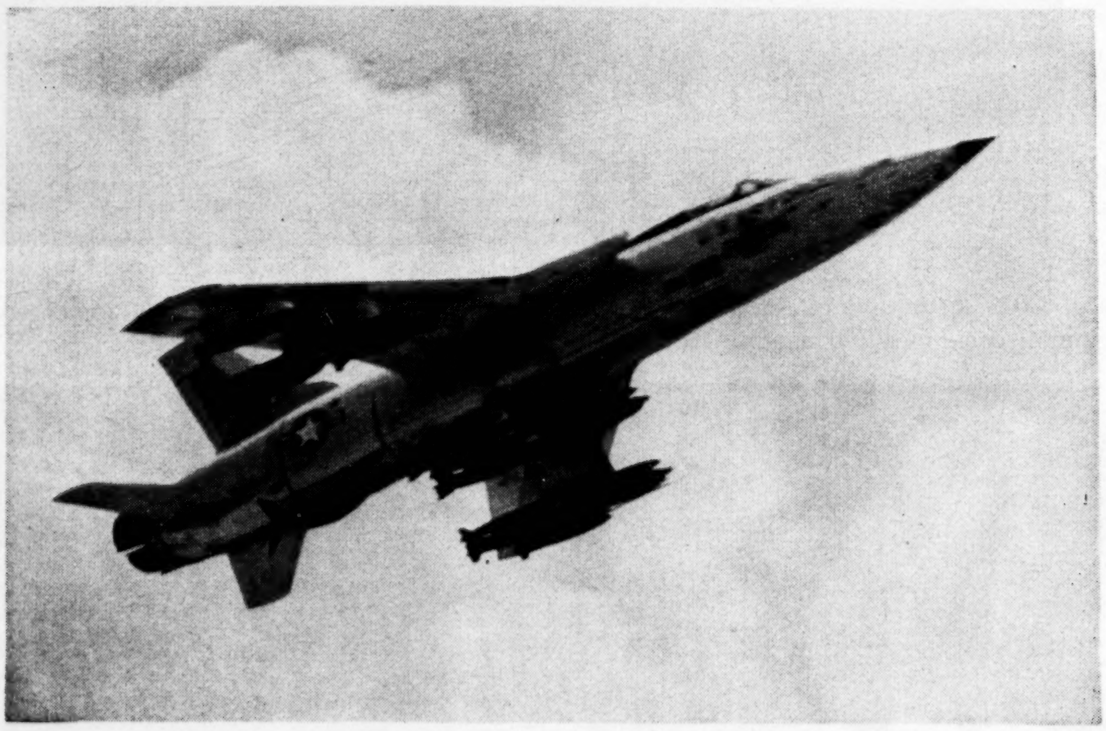
Central Airlines—Keith Kahle, president, $18,000 salary, 26,004 shares of common stock, $2,660 expenses; **F. E. Howe**, executive vice president, $17,000 salary, 1,525 shares of common stock, $851 expenses; **R. L. Wageneck**, vice president-operations, $16,000 salary, 500 shares of common stock, $489 expenses; **A. S. Aldridge**, vice president-sales, $13,000 salary, 2,896 shares of common stock, eight shares of preferred stock, $2,489 expenses; **C. E. Lundstrom**, secretary-assistant treasurer, $10,900 salary, 553 shares of common stock, $179 expenses: **W. A. Whitlock**, chief pilot, $14,400 salary, no stock, $51 expenses; **F. K. Johnson**, chairman of the board, $8,000 salary, 143,239 shares of common stock, no expenses.

Following firms were paid for services rendered during 1960: **Pogue & Neal**, legal, $24,724; **Mueller & Mueller**, labor consultant, $28,493; **Marvin Gwinn & Associates**, advertising, $24,740; **E. H. Pickering**, research consultant, $6,875; **Hudson, Keltner, Jordan & Cunningham**, legal, $10,939; **Billups, Wood & Mascho**, audit, $5,750; **S. S. Colker & Associates**, research consultant, $6,474.

Lake Central Airlines (All Lake Central officers, salaries and other compensation date from Apr. 11, 1960). **Dr. R. B. Stewart**, chairman of the executive committee, board of directors, no salary, 1,500 shares of common stock, no expenses, $3,000 bonus and indirect compensation; **J. J. O'Connell**, chairman of the board, $2,400 salary, 2,166 shares of common stock, $677 expenses, $1,150 bonus and indirect compensation; **G. Hicks**, president and director, $18,999 salary, 6,532 shares of common stock, $5,303 expenses; **L. W. Hartman**, executive vice president and director, $20,856 salary, 5,400 shares of common stock, $3,184 expenses; **W. H. Krieg**, secretary and director, no salary, 1,878 shares of common stock, no expenses, $600 bonus and indirect compensation.

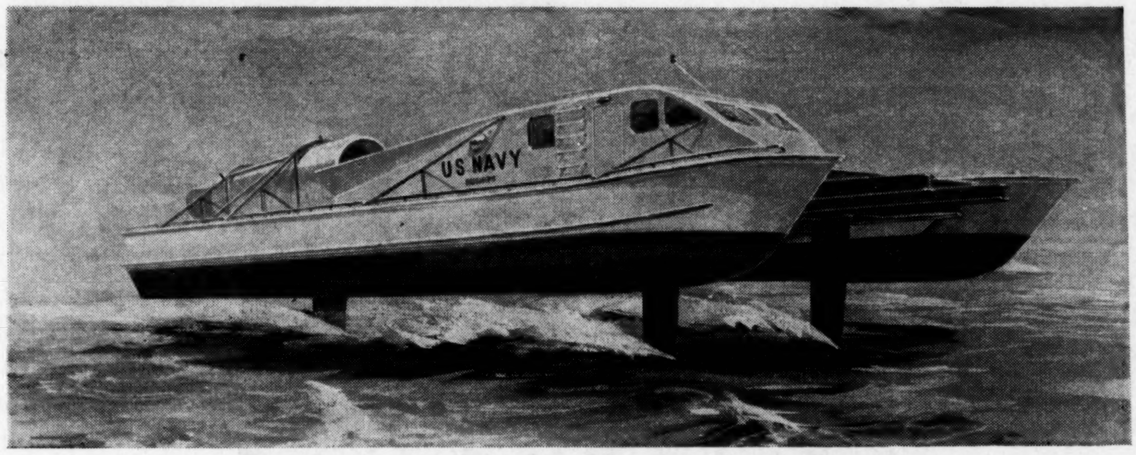
R. W. Clifford, vice president and director, $15,000 salary, 2,339 shares of common stock, $1,107 expenses; **J. D. Peterson**, director, no salary, no stock, no expenses, $600 bonus and indirect compensation; **C. A. Berry**, director, no salary, no stock, no expenses, $400 bonus and indirect compensation; **H. Goff**, director and flight captain, $14,886 salary, 1,500 shares of common stock, $538 expenses; **A. E. Sabe**, director and chief pilot, $15,177 salary, 4,230 shares of common stock, $496 expenses.

D. S. Getshell, vice president, $12,999 salary, 133 shares of common stock, $1,017 expenses; **J. L. Cory**, treasurer and assistant secretary, $9,999 salary, 4,100 shares of common stock, $295 expenses; **A. F. Grisard**, assistant secretary, no salary, 4,181 shares of common stock, no expenses; **J. R. Carr, Jr.**, assistant secretary, no salary, 509 shares of common stock, no expenses; **R. P. West**, assistant secretary, no



Republic F-105 Carries Seven Tons of Bombs

Republic F-105 carries more than seven tons of conventional bombs during tests at Eglin AFB, Fla. A total of 26 bombs weighing 565 lb. each are mounted in clusters and singly under the wings and the fuselage. Republic claims that the total weight carried by the F-105 is the greatest ever carried by a single-engine fighter.



Boeing to Build Hydrofoil Boat

Highly instrumented twin hull hydrofoil test boat, shown above in artist's sketch, will be built by Boeing Co. for Navy's BuShips to help search for solutions to vapor cavity problems which limit speed of hydrofoils. A turbofan jet engine will power the boat to speeds of 100 kt. and two 75-hp. outboard motors will power the ship when cruising on hull. Cost of the ship is estimated at approximately $1.5 million.

salary, 1,233 shares of common stock, no expenses; **E. M. Blair**, director, no salary, 16,700 shares of common stock, $207 expenses, $700 bonus and indirect compensation; **W. Chope**, director, no salary, no stock, no expenses, $300 bonus and indirect compensation.

W. W. Brown, director, no salary, 2,000 shares of common stock, no expenses, $300 bonus and indirect compensation; **T. Mikita**, director and chief pilot, $14,155 salary, 400 shares of common stock, $854 expenses; **J. Horn**, director and chief pilot, $13,756 salary, 1,000 shares of common stock, $716 expenses; **M. M. Ersulchek**, director, $4,225 salary, 19,669 shares of common stock, $3,817 expenses, $200 bonus and indirect compensation.

Following firms were paid for services rendered during 1960: **Albert F. Grisard**, legal, $25,983; **Buschmann, Krieg, DeVault & Alexander**, legal, $19,197.

Frontier Airlines—L. B. Maytag, president-chairman of the board, $18,000 salary, 489,101 shares of common stock, $1,119 expenses; **G. R. Woody**, executive vice president, $27,480 salary, no stock, $381 expenses; **J. D. Brock**, vice president-traffic and sales, $15,900 salary, no stock, $916 expenses; **R. P. Minniear**, vice president-operations (from May 1, 1960), $8,000 salary, no stock, $271 expenses; **E. E. Dolansky**, treasurer (from May 1, 1960), $8,583 salary, no stock, $534 expenses; **R. W. Dunn**, assistant treasurer (from Aug. 1, 1960), $4,166 salary, no stock, no expenses; **J. A. Love**, secretary (from July 1, 1960), no salary, 122 shares of common stock, $140 expenses.

L. Gross, assistant secretary (from Apr. 12, 1960), no salary, no stock, no expenses; **L. P. Blatter**, vice president-finance and treasurer (until Apr. 30, 1960), $9,347 salary, 80 shares of common stock, 25 shares of common stock in the name of others, $284 expenses; **H. P. Barnard, Jr.**, vice president-operations (until Apr. 30, 1960), $9,061 salary, 225 shares of common stock, $372 expenses; **D. W. Rausch**, assistant treasurer (until July 8, 1960), $6,299 salary, 10 shares of common stock, $340 expenses.

H. Dean, director (from May 29, 1960), no salary, 100 shares of common stock, no expenses; **R. W. Goldwater**, director (from July 12, 1960), no salary, 1,000 shares of common stock, no expenses; **L. W. Linville**, director, no salary, 550 shares of common stock, no expenses; **E. B. Slocum**, director, no salary, no stock, no expenses, $600 bonus and indirect compensation; **P. Walker**, director, no salary, 50 shares of common stock, no expenses;

Following firms were paid for services rendered during 1960: **Bowen & Rasenburger**, legal, $20,584; **Rippey Henderson, Buchmun Co.**, advertising, $16,798; **Colin Hugh McIntosh**, air transportation consultant, $6,570.

Mohawk Airlines—R. E. Peach, president and director, $38,000 salary, 10,000 shares of stock, $3,953 expenses, $27,000 debt securities; **J. R. Carver**, vice president and director, $25,000 salary, 4,018 shares of stock, $3,109 expenses, $2,000 debt securities; **C. A. Benscoter**, vice president-director, $25,000 salary, 3,782 shares of capital stock, $780 expenses, $5,000 debt securities; **E. V. Underwood**, chairman of the board, $4,500 salary, 3,000 shares of stock, $258 expenses, $1,000 debt securities; **F. R. Chabot**, treasurer, $16,500 salary, 100 shares of capital stock, $987 expenses.

B. C. McLean, secretary, $11,666 salary, no stock, $1,960 expenses, $500 debt securities; **B. J. Miner**, director, no salary, 133 shares of stock, no expenses; **W. J. Fields**, director, no salary, 1,000 shares of stock, no expenses; **E. A. Link**, director, no salary, 24,111 shares of stock, no expenses, $125,000 debt securities; **P. A. Schoellkopf**, director, no salary, no stock, no expenses; **J. C. Cornwith**, director, no salary, no stock, no expenses.

W. V. Daugherty, director, no salary, 2,500 shares of stock, no expenses, $7,000 debt securities; **C. W. Sorrell**, director, no salary, 151 shares of stock, no expenses; **L. P. Hornbrook**, assistant secretary, $5,460 salary, 16 shares of stock, $378 expenses; **H. R. Thomas**, assistant secretary, $7,000 salary, 15 shares of stock, $667 expenses; **R. V. Stephenson**, vice president, $13,000 salary, 150 shares of stock, $1,691 expenses.

R. R. Taylor, vice president (from May 1, 1960), $13,666 salary, 254 shares of stock, $1,293, expenses; **D. B. Billings**, director, no salary, no stock, no expenses; **H. W. Harding**, director, no salary, no stock, no expenses; **H. P. Barnard**, vice president (from July 1, 1960), $13,000 salary, no stock, no expenses; **A. D. Williams**, assistant treasurer, $8,900 salary, no stock, no expenses; **P. D. Stump**, director, (from Apr. 21, 1960), no salary, 20 shares of stock, no expenses.

Following firms were paid for services rendered during 1960: **Gilfoil and McNeal**, audit, $17,963; **Pogue & Neal**, legal, $15,676; **Alexander & Green**, legal, $33,300.

Avalon Air Transport—W. R. Probert, $12,500 salary, 175 shares of common stock, $2,216 expenses, $10,000 debt securities; **G. C. Probert**, director, no salary, no stock; **W. B. von Kleinsmid**, vice president and secretary-treasurer, $12,500 salary, 175 shares of common stock, $2,002 expenses; **H. von Kleinsmid**, director, no salary, no stock.

Avalon Air Transport did not pay any firms more than $5,000 during 1960.

Samoan Airlines, Ltd.—L. M. Coleman, president, $12,000 salary, 452 shares of common stock.

Samoan Airlines did not pay any firm more than $5,000 during 1960.

Slick Airways—E. F. Slick, chairman, no salary, 167,983 shares of common stock, $8,194 expenses, $1,167,000 debt securities; **T. B. Slick**, director, no salary, 84,545 shares of common stock, $504 expenses, $500,000 convertible debentures sold in January and February, 1961 to certain officers, directors and others; **L. J. Moorman**, director, no salary, one share of common stock, $693 expenses; **C. F. Urschel, Jr.**, director, no salary, 8,501 shares of common stock, $1,306 expenses; **D. E. Bright**, director, no salary, 20,170 shares of common stock, $552 expenses; **S. E. Milbank**, director, no salary, 200 shares of common stock, $36 expenses, $25,000 convertible debentures (since January-February, 1961); **J. E. Parker**, director, $25,000 salary; 10,725 shares of common stock, $8,384 expenses, $50,000 convertible debentures (since January-February, 1961); **W. E. Miller**, assistant secretary, no salary, 2,500 shares of common stock, $253 expenses; **A. W. Johnson**, executive vice president and director, $25,000 salary, no stock, $7,727 expenses, $5,000 bonus and indirect compensation, 35,000 converver-tible debentures (since January-February, 1961); **W. E. Hollan**, director, no salary, two shares of common stock, $512 expenses, $5,000 convertible debentures (since January-February, 1961); **H. P. Huff, Jr.**, vice president, $21,538 salary, no stock, $4,503 expenses, $3,000 bonus and indirect compensation; **J. H. Malone**, assistant treasurer, $12,724 salary, no stock, $2,833 expenses, $1,200 bonus and indirect compensation; **D. W. Rentzel**, director, no salary, no stock, $19,662 expenses, $15,000 bonus and indirect compensation (consultant's fee), $50,000 convertible debentures (since January-February, 1961); **A. L. Butler, Jr.**, director, no salary, 300 shares of common stock, $437 expenses; **R. G. Woods**, no salary, one share of common stock, $50,000 convertible debentures (since January-February, 1961); **T. G. Alexander**, director (Apr. 15-Oct. 13, 1960), no salary, no stock, $416 expenses; **H. C. Inkenberry, Jr.**, director (Apr. 15-July 26, 1960), no salary, no stock; **O. N. Crider**, assistant secretary (from July 26, 1960), $8,000 salary, no stock, $500 bonus and indirect compensation; **J. E. Gallagher**, vice president and director (from July 26, 1960), $20,000 salary, no stock, $9,126 bonus and indirect compensation; **J. A. Frates**, director (from Dec. 9, 1960), no salary, 250 shares of common stock, $15,000 convertible debentures (since January-February, 1961).

Following firms were paid for services rendered during 1960: **Steptoe & Johnson**, legal, $113,038; **Harold Nein**, consultant, $11,365; **Price Waterhouse & Co.**, audit, $14,875; **Gartley & Associates, Inc.**, professional services, $6,923.

Caribbean Atlantic Airlines—D. Trigo, president, $25,000 salary, 18,221 shares of common stock, $5,900 expenses; **B. Trigo**, vice president, $10,000 salary, 18,221 shares of common stock; **J. M. Sierra**, vice president-operations, $15,000 salary, 208 shares of common stock, $2,543 expenses, $2,543 bonus and indirect compensation; **R. B. Forrest**, vice president-traffic, $10,600 salary, four shares of common stock, $6,359 expenses, $1,000 bonus and indirect compensation; **L. A. Lockhart**, treasurer, $9,600 salary, 260 shares of common stock, $529 expenses, $1,000 bonus and indirect compensation; **J. Gonzalez**, secretary (since Mar. 28, 1960), no salary, no stock; **R. S. Fleming**, director (since Mar. 28, 1960), no salary, no stock; **J. Trigo**, director, no salary, 11,890 shares of common stock; **F. Ballester**, director, no salary, 435 shares of common stock; **I. Paiewonsky**, director, no salary, no stock; **D. V. Bornn**, director, 150 shares of common stock.

Following firms were paid for services rendered during 1960: **Whiteford, Hart, Carmody and Wilson**, legal, $17,342.

Trans Caribbean Airways (Transportation Co. of America)—O. R. Chalk, president, (since Apr. 25, 1960), $25,000 salary, 27,236 shares of Class A stock, 766,727 shares of Class B stock; **Claire Chalk**, secretary, no salary, 122,942 shares of Class A stock, 465,703 shares of Class B.

Following firms were paid for services rendered during 1960: **Leonard Wolfe**, advertising, $88,566; **A. F. Lewson**, audit, $18,832; **Harry D. Breslau**, legal, $2,856; **Theodore I. Seamon**, legal, $15,893; **Hernan Franco**, legal, $2,521; **Emil Rogers**, legal, $21,850.

South Pacific Air Lines—R. S. Dollar, Jr., chairman, no salary, no stock, $536 expenses; **H. C. Heacock**, director, no salary, 25 shares of common stock; **J. H. Dollar, Jr.**, president and director, no salary, no stock, $8,816 expenses; **W.**

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Sternberg, director, no salary, no stock, $9,530 expenses, $28,875 bonus and indirect compensation; **R. H. Anderson,** director, (until Dec. 14, 1960), no salary, no stock; **J. G. Mitchell,** director (since Dec. 14, 1960), no salary, no stock; **J. D. Hopkins,** vice president, no stock no salary; **W. F. Warren,** vice president, no salary, no stock, $1,839 expenses; **S. L. Wilson,** vice president, $23,500 salary, no stock, $2,339 expenses; **J. D. Fessio,** vice president (from Feb. 10, 1960), $18,000 salary, $3,664 expenses; **G. A. Harrison, Jr.,** treasurer, no salary, $1,652 expenses; **R. P. Seeley,** secretary, no salary, no stock; **D. C. Nichols,** assistant secretary treasurer, $5,926 salary, no stock, $920 expenses; **C. J. Patterson,** assistant treasurer, no salary, no stock; **M. D. Voci,** assistant secretary, no salary, no stock.

Following firms were paid for services rendered during 1960: **Bowen & Rasenberger,** legal, 44,011; **S. S. Colker & Associates,** consultant, $6,688; **Fuller & Smith & Ross, Inc.,** advertising, $57,095; **Roy S. Durstine, Inc.,** advertising, $15,922.

Resort Airlines—M. M. Townsend, president and director, $15,000 salary, no stock, $3,000 expenses; **T. B. Wilson,** chairman, $15,000 salary, no stock, $3,000 expenses; **D. P. Larsen,** vice president and director (until Aug. 31, 1960), $10,000 salary, no stock, $2,000 expenses; **V. B. Nixon,** vice president (until Sept. 30, 1960), $9,000 salary, no stock, $2,250 expenses; **J. F. Murray,** vice president and director, (until Dec. 31, 1960), $12,832 salary, no stock, $2,916 expenses; **J. P. Simpson,** vice president and secretary, $8,775 salary, no stock; **T. Nelson,** vice president, $11,050 salary, no stock; **S. Bonjour,** assistant secretary and director, $1,000 salary, no stock; **P. Hackett,** director, (until Dec. 31, 1960), $900 salary, no stock; **E. M. Bishop,** assistant secretary, $7,150 salary, no stock.

Chicago Helicopter Airways—J. S. Gleason, president, treasurer and director, $28,000 salary, 30,842 shares of common stock, 3,750 shares of common stock held in voting trust, $2,272 expenses, $250 bonus and indirect compensation; **C. W. Moore,** executive vice president and director, $25,000 salary, 10,000 shares of common stock, 400 shares held in voting trust, $1,933, expenses, $250 bonus and indirect compensation; **R. B. Kiel,** assistant secretary-treasurer, $13,000 salary, no stock, $521 expenses; **R. S. Angstadt,** vice president-operations, $17,500 salary, 300 shares of common stock, $2,037 expenses; **J. C. Brogan,** vice president, secretary and director, $9,600 salary, 6,781 shares of common stock, 2,015 shares of common stock held in voting trust, $68 expenses, $250 bonus and indirect compensation; **C. E. Liske,** vice president-traffic and sales, $12,500 salary, 50 shares of common stock held in voting trust, $1,545 expenses; **W. Kirkland,** director, no salary, no stock, $100 bonus and indirect compensation; **J. P. Ringley,** director, no salary, no stock, 2,000 shares of common stock held in voting trust, $959 expenses, $200 bonus and indirect compensation; **R. A. Podesta,** director, no salary, 240 shares of common stock, $150 bonus and indirect compensation; **A. C. Stephan, Jr.,** director, no salary, 400 shares of common stock, $100 bonus and indirect compensation.

Following firms were paid for services rendered during 1960: **Kirkland, Ellis, Hodson, Chaffetz and Masters,** legal, $21,046; **Arthur Anderson and Co.,** accounting, $14,092; **Pogue and Neal,** legal, $10,174.

Los Angeles Airways—C. M. Belinn, president, $25,000 salary, 6,163 shares of common stock, $3,308 expenses; **J. T. Kane,** vice president and treasurer, $15,167 salary, no stock, $1,064 expenses; **F. W. Milam,** vice president-transportation, $14,000 salary, 456 shares of common stock, $206 expenses; **E. H. Slingsby,** assistant treasurer (since May 27, 1960), $9,175 salary, no stock; **M. F. Bagan,** vice president and assistant to the president, $10,333 salary, no stock, $706 expenses; **W. C. Jordan,** director, $150 salary, 100 shares of common stock; **J. G. Lombardi,** director, $200 salary, no stock; **H. Judd,** director (since Feb. 25, 1960), $100 salary, no stock, $153 expenses; **K. W. Dyal,** director, $200 salary, no stock; **M. J. Burke,** secretary, no salary, no stock.

Following firms were paid for services rendered during 1960: **Burke, Williams & Sorensen,** legal, $5,290.

Piedmont Aviation—T. H. Davis, president and treasurer, $30,000 salary, 133,821 shares of common stock, $3,768 expenses, $50,000 debt securities; **C. G. Brown,** vice president and director, $15,000 salary, 4,200 shares of common stock, $1,861 expenses; **H. K. Saunders,** vice president and director, $18,000 salary, 4,225 shares of common stock, $1,267 expenses; **R. S. Northington,** vice president and director, $16,649 salary, 6,100 shares of common stock, $3,815 expenses.

M. F. Fare, secretary and assistant treasurer, $12,504 salary, 6,401 shares of common stock, $1,820 expenses; **T. W. Morton,** assistant controller, $9,250 salary, 200 shares of common stock, $472 expenses; **J. R. Farley,** assistant secretary (from July 28, 1960), no salary, no stock, no expenses; **G. E. Anderson,** director, no salary, 800 shares of common stock, no expenses, $200 bonus and indirect compensation; **E. L. Davis,** director, no salary, 8,036 shares of common stock, no expenses, $200 bonus and indirect compensation.

E. L. Davis, Jr., director, no salary, 5,622 shares of common stock, no expenses, $150 bonus and indirect compensation; **F. Dowd,** director, no salary, 1,000 shares of common stock, $37 expenses, $100 bonus and indirect compensation; **R. W. Gardner,** director, 13,000 shares of common stock, no expenses, $50 bonus and indirect compensation; **B. Gray,** director, no salary, 10,000 shares of common stock, no expenses; **C. E. Norfleet,** director, no salary, 2,679 shares of common stock, $37 expenses, $150 bonus and indirect compensation.

Following firms were paid for services rendered during 1960: **Kilpatrick, Ballard and Beasley,** legal, $27,756; **Liller, Neal, Battle and Lindsey, Inc.,** advertising, $163,456; **Ernst & Ernst,** audit, $7,683.

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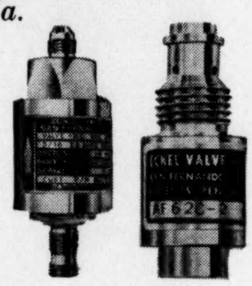

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New Offerings

The Turbodyne Corp., Washington, D. C., organized under Maryland law in December, 1960, for the general purposes of researching, developing, manufacturing and marketing air breathing engines, rocket propulsion engines, engines which would use heat as a source of prime power for reactive propulsion, or space engines using space nuclear sources for reactive propulsion in outer space and areas of product and technological development related thereto. To date the company's activities have been entirely organizational; its present business consists in perfecting a new type of gas turbine engine with a combined heat exchanger, said to be improved, which is the invention of Dusan Premovic, a vice president, for which patent applications have been filed and on which further extensive research and development are required. Offering is 200,000 shares of common stock, for public sale at $2 per share. In the event the Premovic invention is developed jointly by the company and an existing gas turbine manufacturer (toward which negotiations are now in progress), the proceeds will be used for operating capital and research facilities and salaries; if the invention is developed without any such relationship or assistance, the proceeds will be used principally for research and development activities as well as working capital.

Reher Simmons Research, Inc., Bridgeport, Conn., organized under Connecticut law in May, 1960, for the purpose of researching further and developing on a commercial basis certain methods, processes and ideas of Eugene C. Simmons, president, and Dorothy M. Reher, vice president, related primarily to the fields of surface and biochemistry. The company is still in the promotional and development stage, and the said methods, processes and ideas will require further research and refinement to establish their validity and to develop their commercial feasibility. The most fully developed of the processes which the company proposes to market commercially is a process for the application of a bonded solid film lubricant to small, miniature or sub-miniature parts. Offering is 150,000 shares of capital stock for public sale at $6 per share; offering to be made on an all or none best efforts basis. Of the estimated proceeds, $350,000 will be used for plant construction, additional facilities, production equipment, test instrumentation, all relating to the bonded solid film lubricant; $441,100 for research and development, development of a sales organization and general working capital.

STARS FOR SATURN

Assignment: manufacture star-shaped flame shields, heat shields, and other important structures for NASA's Saturn booster. That's only one side of the Lockheed/Georgia aerospace story. We offer space-oriented research (cryogenic lab, hypersonic shock tunnel, human factors). We know how to build huge structures. And we're at the hub of the Strategic Southeast—practically next door to Huntsville and Cape Canaveral. **LOCKHEED/GEORGIA**
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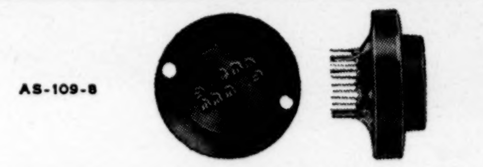
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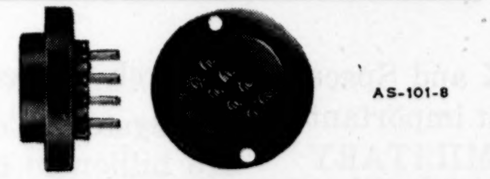
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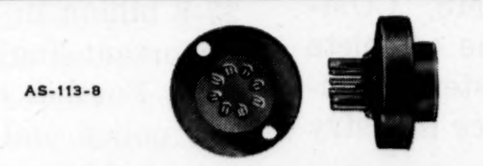
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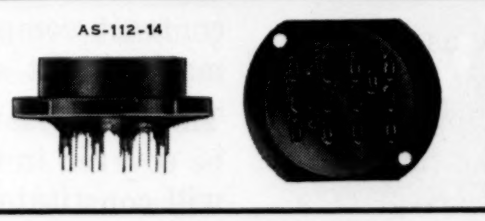
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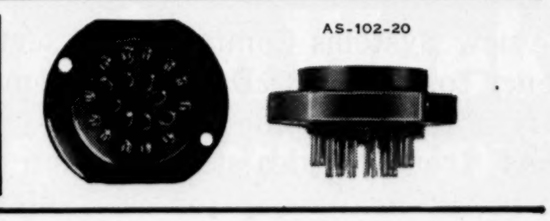
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“FORGING

On September 25, AVIATION WEEK and Space Technology will publish one of the most important issues in its history . . . “FORGING MILITARY SPACEPOWER” – USAF SYSTEMS COMMAND ISSUE. For the first time, the complete story of the newly activated USAF Systems Command will be presented to the aerospace industry throughout the world.

The new Systems Command will serve as a single agency to control R&D and procurement of all aircraft, missile, avionic and space systems for the USAF from the idea stage through the time they are in the field ready for use. This concept of a single agency for both systems R&D and systems procurement will have penetrating impact on all aerospace industry companies selling hardware or research services to the Air Force.

The Systems Command will control approximately $15 billion in contracts and annually will award $7-8 billion in new contracts making it the most important single source of aerospace industry business. Further evidence of the impact on industry are policy and procedure changes which can be expected in many areas such as technical approach, contract competition, proposals, cost estimating, management structure and subcontracting.

These are just a few of the important details to be covered in the Systems Command Issue, which will constitute a new handbook in doing business with the Air Force. Teams of AVIATION WEEK editors are now visiting the various bases of the Command for full, complete reports. Detailed edi-

MILITARY SPACEPOWER"

USAF SYSTEMS COMMAND ISSUE

SEPTEMBER 25, 1961

torial coverage will be given to procurement, organization, plans and programs, policies, procedures and future technical activities.

AVIATION WEEK is privileged to present this edition to the industry covering our newest and vitally important Command. Prime contractors, subcontractors, suppliers and firms doing R&D work for the Air Force will be extremely interested in this new issue which will lay the groundwork for future contacts with the Command. It will supersede all previous editions on USAF research, development and procurement policies.

Your company is urged to participate by advertising its capabilities and facilities for the furtherance of the defense effort. Write, wire or call collect for space reservations.

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BUSINESS FLYING

U.S. Sailplane Market Potential Increasing

By Erwin J. Bulban

Wichita, Kan.—Growth of the U.S. sailplane movement as a potential market was apparent during the 28th annual soaring championships here Aug. 1-10.

Major increases in the number of soaring enthusiasts, plus a noticeable sophistication in design of new sailplanes toward higher performance and growing acceptance of higher-priced vehicles, portends that this is becoming a field of interesting potential for airport and flying service operators as well as new electronics and other aircraft equipment suppliers.

Registration Increase

As a measure of the increased growth of the soaring movement, there has been an increase of 113% in national sailplane registrations in the last three years, a Federal Aviation Agency observer noted here to AVIATION WEEK. And a member of the Kansas Soaring Association, which conducted the meet here, added that in that state he knew of no sailplanes five years ago—he estimated that today there were approximately 18 and the state organization has some 80 members.

Just as impressive was the expression of what this increase in interest is meaning in hard dollar-volume terms to the top-ranking sailplane manufacturer in the United States, Schweizer Aircraft Corp., Elmira, N. Y., which was formed in 1935 to build these unpowered aircraft.

Sailplane demand has developed to the point where this year the company had already built as many aircraft up to July as it did all of last year, Paul Schweizer stated, and he expects that volume will continue so that the company should just about double the business it did last year, when it turned out between 30 and 35 sailplanes. Indications are that dollar volume, including the company's school, sales of literature and other allied sailplane operations will total some $250,000 this year.

Production, which is now running at about one complete sailplane every two days, including some military orders, is divided at approximately 90% on the two-place 2-22C and single-place 1-26 (divided about evenly between these two models) with the remaining 10% being taken up by the single-place 1-23.

Initial Details

Initial details of a new high-performance sailplane planned by the company for delivery next year were discussed briefly by Schweizer. The new model 2-32 is aimed at broadening the numbers of enthusiasts by making it possible for sailplane pilots to introduce the sport to friends and members of their families at a higher performance level than the company's previous types. It has the capability of being used as an advanced trainer for soaring and cross-country work and also may be used for competition, record and award flights in the single and two-place categories.

The increased emphasis by current owners for higher-performance is one of the important criteria considered in the basic design, Schweizer explained.

The fuselage will be all-metal monocoque construction, with wings of metal construction with ailerons and possibly some portion of the wings fabric covered. Seating will be tandem, with the rear passenger seated higher. There will be more room for the pilot's feet than in the earlier model 2-25. The canopy will be one-piece and the tail will be swept.

A prototype 2-32 now is under construction. The company plans to hold off decision on tooling up for production until this fall.

Among the interesting new designs present during the meet here, indicative of attempts at sophistication which marked advanced classes of new sailplanes, were National Champion Richard Schreder's HP-10 featuring a novel wing makeup consisting for the most part of metal honeycomb construction and having a Royalite plastic material leading edge. The Toledo, Ohio, pilot has plans to market the HP-10 in kit form at a price of approximately $3,500.

Design Highlight

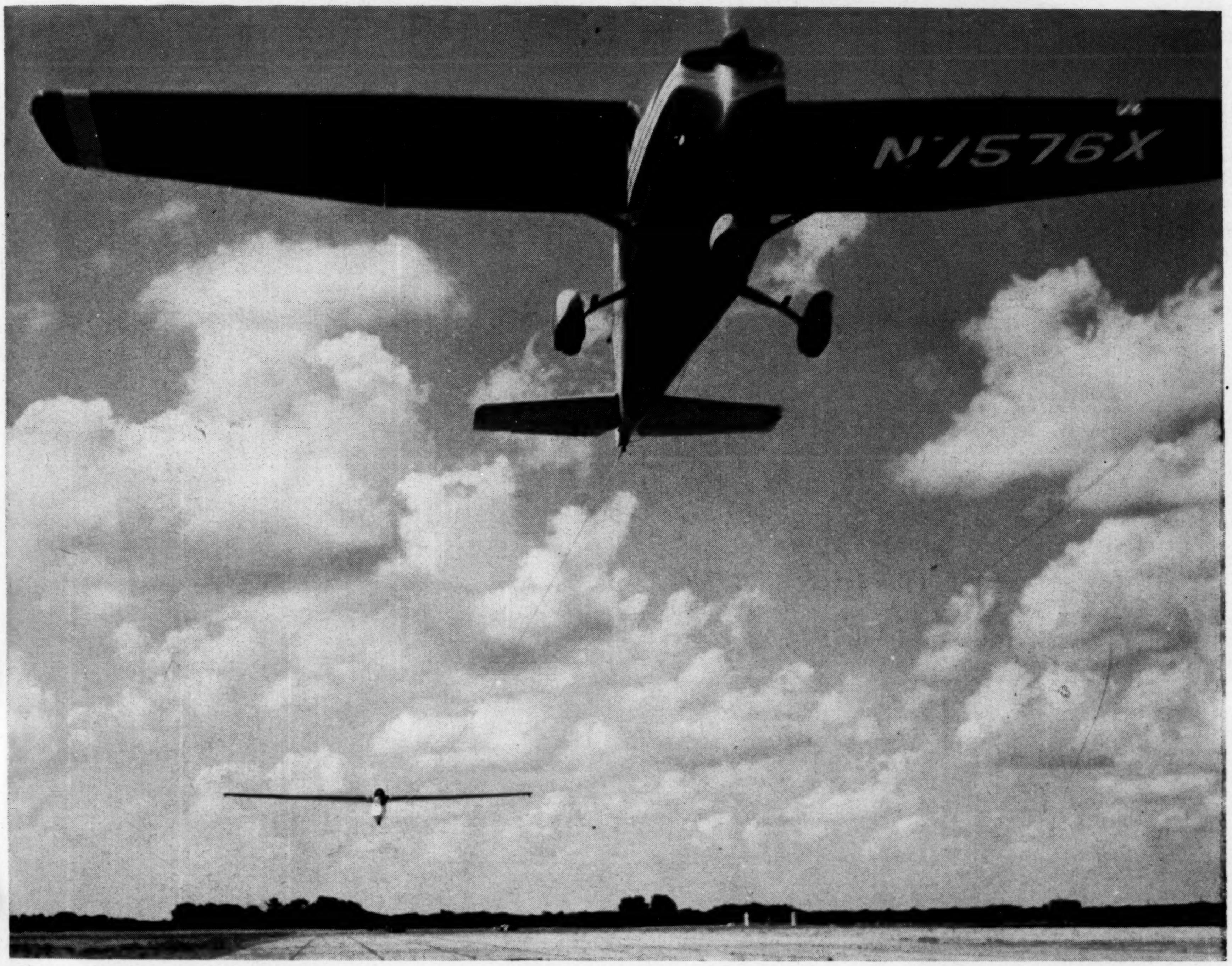
The other new sailplane was Leonard Niemi's Sisu—a $10,000-class type in complete form—of all-aluminum construction. A highlight of this design was the interesting approach in trailing edge flaps—Sisu utilizes trailing edge mechanical warping to achieve optimum cleanliness of the wing surface by eliminating gaps caused by conventional separate surfaces. This approach also considers simplifying construction by eliminating the need for building separate flap components and hinging them to the wing. This high-performance sailplane, which has a 63-series airfoil, is aimed at a glide ratio of approximately 43.1, and has achieved an average speed of 100 mph. for over two hours on cross-country flights, AVIATION WEEK was told.

Indications are that Sisu now has about nine orders. Aircraft will be built in Arlington, Tex.

Foreign designs comprised a good percentage of the 36 sailplanes attending the competition here — approxi-

Hiller E4 Used to Fight Forest Fire

Hiller E4 helicopter shuttles fire fighters to blaze in Sequoia National Forest. Rotary-wing craft carries three fire fighters, their equipment and paper sleeping bags. The aircraft also could be fitted with a detachable water bag to make water drops to fire fighters. Helicopter utilization during the fire was 6 hr. per day, maximum allowed by the U. S. Forest Service.



CESSNA 172 launches Cherokee II during practice session prior to National Soaring Assn. meet at Wichita, Kan. recently. Flight was made from Strother Field, near Wichita. Bill Thompson, Cessna chief of experimental flight test, is piloting tow plane and Paul Wilson is piloting sailplane. Cessna Aircraft provided three 182s, a 175 and a 172 as tow aircraft during the meet. The Cessna airplanes were able to tow gliders to a 2,000 ft. altitude in about five minutes time.

mately half of those present were imports, primarily German types.

Competition provided by these imports was pointed up by an industry participant, who noted that one model, the K-8B costs approximately $3,200, landed at New York. With the German firm having an over-all overhead some four to five times less than that of a comparable U. S. manufacturer—wage rates are approximately 55-60¢ per hour—it can easily undersell any comparable domestic product here even with duty and shipping costs.

Indications are, however, that there is little bitter feeling regarding this price differential—at present the thinking is that the market potential is so large that these imports as yet do not seriously hamper domestic producers and the low cost helps spur interest which, it is felt, will in the future aid domestic builders when the user seeks a higher performance type and swings toward metal construction.

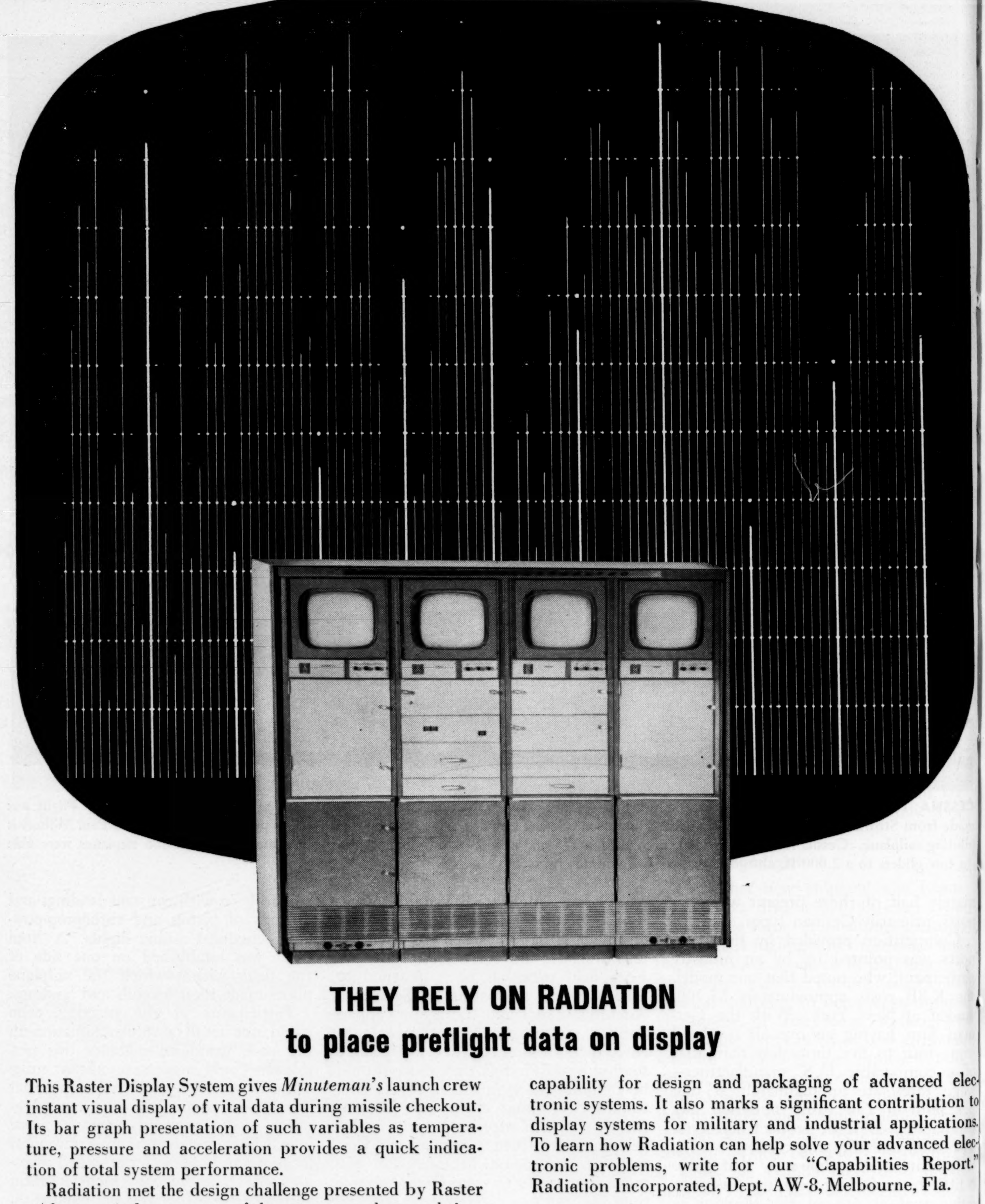
Indications are that the rapid growth of sailplane interest has caught the attention of the Federal Aviation Agency and that it has increased its attention regarding the movement. At least one FAA field man has been assigned to take a course in soaring at Schweizer Aircraft's school and the agency apparently is assigning additional people to cover the movement more closely. Some soaring observers feel that there should be definite efforts made on their part toward developing closer liaison with the FAA which may be helpful in development of future regulations that may be considered necessary as the movement grows to even larger proportions.

Airport Usage

A solid indication that the agency considers that sailplane pilots are a mature group was evidenced by the fact that this meeting received permission to hold its competition on busy Wichita Municipal Airport, with tower operators fitting sailplane operations smoothly in with constant landings and takeoffs of piston and turboprop-powered scheduled airline flights. A "foul line" was established on one side of the field, within which the sailplane pilots made their takeoffs and landings.

Participants at the meeting, who could not recall a similar situation in the past, wondered whether this permission could mark a significant milestone in soaring growth, reasoning that should such a privilege be extended to other areas it would have the dual benefit of providing more convenient locations to hold better attended meetings due to more convenient location and proximity to fair-sized population centers. Additional public interest would be created and spectators would find it easier to watch the competitions and larger audiences could be expected.

Judging from the comments of some participants, Cessna Aircraft, which supplied late model 182s and a 172 and 175 as tow planes, may have provided a demonstration of these air-



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to place preflight data on display

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Sailplane Winners

Wichita, Kan.—Piloting a German LO-150 sailplane, A. J. Smith, Tecumseh, Mich., won the 28th annual National Soaring Championship here. Smith moved up from third place to first on the final day of the meet by taking the final event—an 80-mi. speed run from Wichita Municipal Airport to Salina, Kan., municipal airport—with an average speed of 42.2 mph. His final score tallied 4,564 points.

Second place went to William S. Ivans, Jr., San Diego, Calif., flying a British Skylark, who averaged 40 mph. in the final day's speed event to accumulate 4,345 points, bringing him up from fifth place. Second best speed in the event was 41 mph., made by Kit Drew, Hazelcrest, Ill., flying a German KA 6B. His final point score was 4,218.

Third place in scoring went to Rudy Allemann, Richland, Wash., flying a German KA 6CR, with 4,294 points.

planes' capabilities in this area that could increase use of these types for this work.

As one meet official pointed out, local experience using the Cessnas has been very promising and the airplanes appeared to have tow characteristics superior to some higher powered types, such as surplus BT-13s. The airplanes have good low speed characteristics permitting tow climb without danger of exceeding the sailplane's limitations, yet rate of climb is so good that rapid turnaround is possible. Cited as an example of turnaround was launch of 35 sailplanes here in 65 min., which the observer thought probably constituted a record so far as a national meeting was concerned.

One Kansas fixed base operator has built a steady weekend and holiday business utilizing a Cessna 182 as a sailplane tow, making approximately $100 a day at this activity. Experience indicates that the 182 can provide a tow to 2,000 ft. in 1/10 a tachometer-hour and the airplane in actual operation has been providing 12 tows per tach-hour. At a rate of $3 per tow, many operators could make this a profitable venture or sideline, one observer felt.

PRIVATE LINES

Kansas Pilots Assn. has formed its own credit union which will have its headquarters in Wichita and has a potential membership, according to its representatives, of 800 people.

Ministry of Transport of Nigeria has purchased a Grumman Gulfstream which will be used to transport government officials in the African nation. Nigerian crew is being U.S.-trained.

Hundredth Brantly B-2 two-place helicopter was delivered to Aero Enterprises, Inc., Dunlap, Ind., recently. Brantly currently is producing 15 helicopters per month at the company's Frederick, Okla., plant.

Federal Aviation Agency Administrator N. E. Halaby, Sen. A. S. Monroney (D., Okla.) and Project Horizon Chairman Fred M. Glass, will be featured speakers at National Business Aircraft Assn.'s 14th Annual Meeting and Forum at Tulsa, Okla., Sept. 26-28. More than 30 manufacturers and conversion firms have indicated that they will display their latest business aircraft in NBAA's static and flight demonstrations at Tulsa Municipal Airport.

Bristol Bulldog Restored

Bristol Bulldog fighter, pre-World War II Royal Air Force fighter, will be presented to the Shuttleworth Collection in Great Britain. Aircraft was rebuilt by Bristol Aircraft and the Jupiter radial engine, being installed in lower photograph, was rebuilt by Bristol-Siddeley Engines, Ltd. Piloting the fighter is Godfrey Auty, Bristol chief test pilot. The aircraft carries British civil registration markings.

New 10-place jet trainer

The Lockheed C-140 is a compact jet transport. It flies fast and high like jet fighters and interceptors — at just a fraction of their operating and maintenance cost. It can train an entire class of students for hours at a time, rather than one man for a few minutes. And students learn the fine art of operating radar and weapon control systems in tactical and strategic aircraft in a favorable environment, because the C-140's entire cabin is pressurized and air-conditioned. Students see the real thing on their radarscopes and instruments. The Lockheed C-140 also can stretch defense dollars when used for navigational aids checking, casualty evacuation, aerospace system flight testing, and for high priority cargo and passengers.

LOCKHEED GEORGIA

Lockheed Aircraft Corporation, Georgia Division, Marietta, Georgia.

PRODUCTION BRIEFING

Telecomputing Corp.'s Advanced Structures Division, Monrovia, Calif., will produce bonded fuselage structural components totaling more than $800,000 for Army's HU-1B Iroquois helicopter under contract from Bell Helicopter.

Follow-on order for a number of Folland Gnat Mark 1 jet trainers has been placed by Royal Air Force. Gnat, due to start service with Flying Training Command, is powered by the Bristol Siddeley Orpheus 101 generating 4,230 lb. thrust. Airplane replaces the Vampire T.11.

Marquardt Corp. will supply sudden expansion (SUE) burner systems for a structural wind tunnel at National Aeronautics and Space Administration's Langley Research Center under a $95,000 contract. Burners will boost tunnel's testing temperature from 600F to a maximum of 2,000F.

Requirements study for a system that would detect or predict emergency situations in spacecraft and react in thousandths of a second to initiate escape will be made by Chance Vought Corp.'s Astronautics Division under a $76,000 contract from USAF's Aeronautical Systems Division. One requirement is that the system signal the astronaut or ground controller of incipient danger and automatically initiate corrective measures to evacuate the crew, from prelaunch through the entire flight.

Northrop Corp.'s Norair Division, Hawthorne, Calif., has received a $79,000 Air Force contract to study sealants for spaceships. Receipt of the one-year contract came after a two-year company-funded research program on sealants.

Ryan Aeronautical Co.'s Aerospace Division, San Diego, Calif., has been awarded a $555,000 contract to provide specialized personnel and services for continuation of Army's Firebee ground launchings at White Sands Missile Range, N. M. The contract also calls for three Model 124-E Firebees, a special Army configuration of the Ryan Q-2C.

Modifications of the TM-76A Mace missile will be performed by the Goodyear Aircraft Corp. under a $3,137,530 contract awarded by the Air Force. Included in the improvements being installed is a rapid fire multiple launch system.

Ampex Corp. has received a $1,436,769 contract from Navy Bureau of Ships for production of 314 two-channel, three-speed magnetic tape recorder/reproducers.

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		R9608-001	R9608-002
TYPICAL ELECTRICAL DATA	Output (volts/ 1000 rpm)	7 (typical) .5-30 available	2
	Rated Speed (rpm)	3600	5000
	Linearity (% to 3600 rpm)	.07	.1
	Winding Resistance (ohms)	125	
	Output Impedance (ohms)	—	36
	Ripple Voltage	2% above 100 rpm	2.5% at 3600 rpm
TYPICAL MECHANICAL DATA	Friction Torque (in. oz.)	0.25	0.25
	Rotor Moment of Inertia (gm-cm²)	7	8
	Weight (oz.)	5.5	5

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Little Falls, New Jersey

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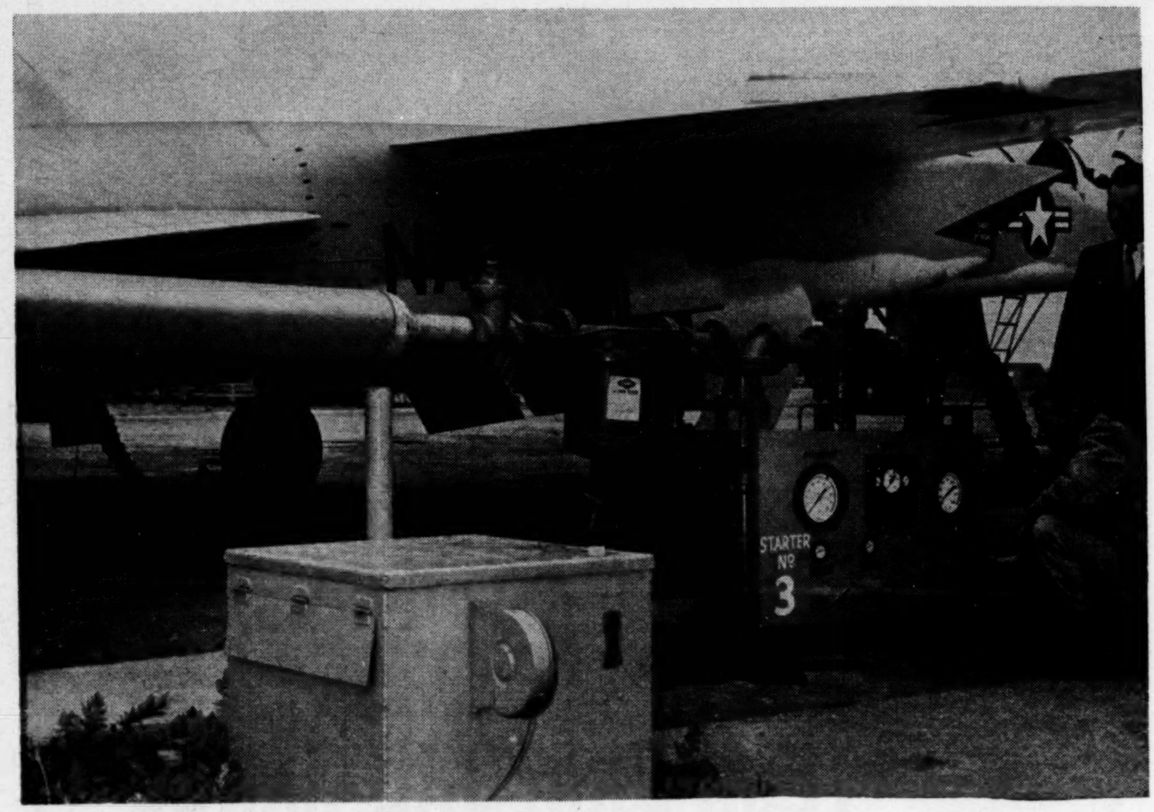
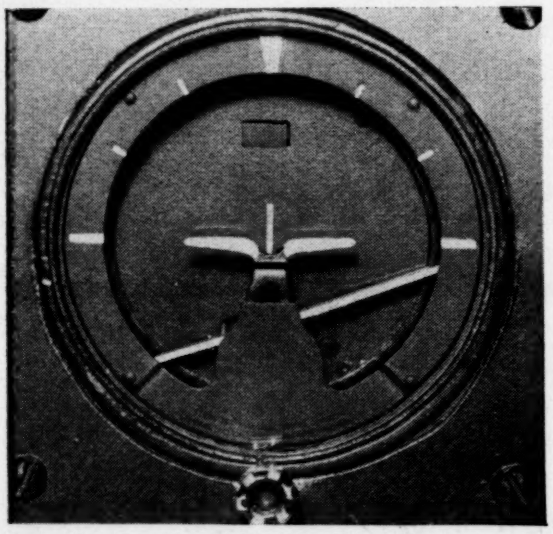


Pressure Pilot-Controller Starts A3J

Pressure pilot-controller permits utilization of plant compressed air for starting jet engines. The device is shown starting a Navy A3J attack aircraft at North American Aviation. The pressure-pilot-controller permits the use of plant compressed air by regulating air pressure so as not to exceed 61 psig. This is the maximum pressure allowable in starting the A3J's General Electric J79 turbojet engines. The price of the regulator unit is $4,500. It is made by U. S. Gauge Division, American Machine and Metals, Inc., Sellersville, Pa.



Integrated Flight Indicator

Low cost integrated flight instrument system for private and business aircraft combines VOR-LOC course deviation indicators and glide slope indicators with the gyro horizon.

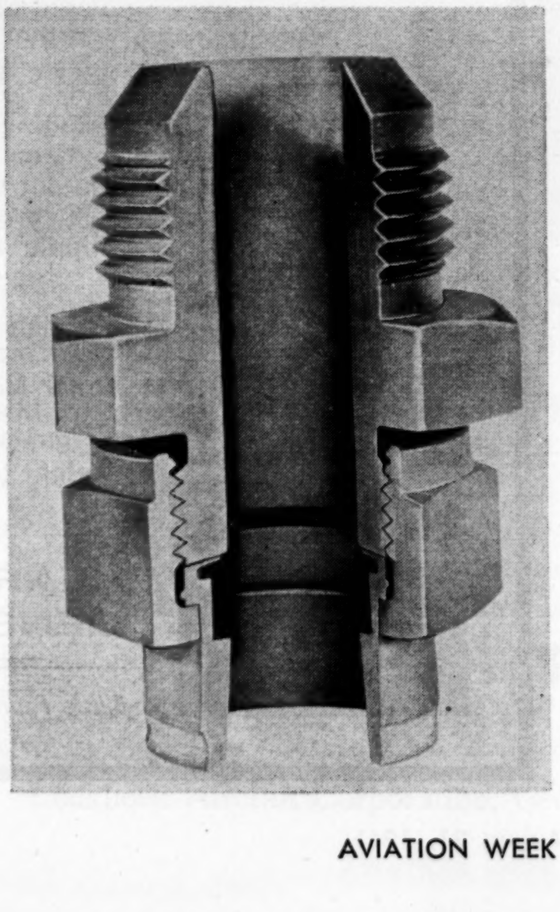
Based on converted Sperry air-driven gyro the indicators are available in two models. Model 1, priced at $1,050, contains a VOR-LOC and to-from indicator. Model 2, costing $1,250, adds a glide slope bar, flag alarm and internal red lighting to the instrument. Meter portion of the units meets ARINC standards (1,000 ohm. meter movements) and the inputs to the pilot instrument were supplied by a Narco omnigator.

Forest City Aviation Service, Inc., 749 Congress St., Portland, Me.

Tube Coupling

Positive-seal tube fitting is designed to reduce leaks in high-performance lines of rocket and turbine engines and ground support equipment.

The Dynatube coupling contains liquids or gases through a basic temperature range of −65 to +700F; cryogenic and 1,000F versions will be available. The coupling is said to be up to 60% lighter than flared fittings and is leakproof at pressures bursting the stainless steel tubing. A full seal over a broad torque range virtually eliminates the need for torque wrench installation. Intended for rigid tubing or high pressure Teflon hose applications, the fittings are produced in −2 to −24 sizes with larger diameters available on special order.

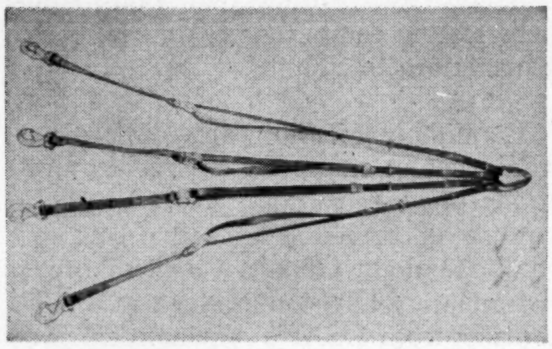


Resistoflex Corp., Roseland, N. J.

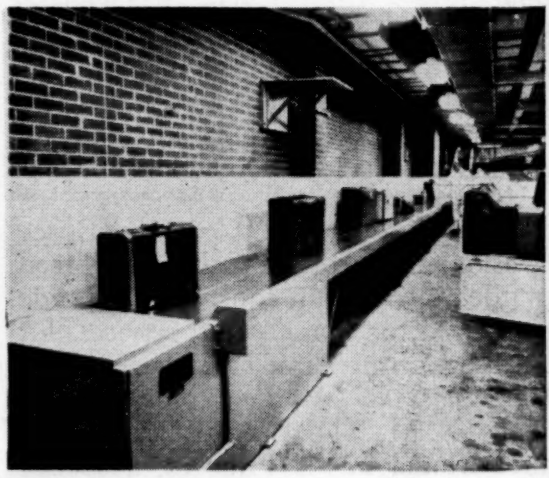
Helicopter Sling

Nylon web helicopter lift sling, in production for the Marine Corps, has a working capacity of five tons.

Each of the four nylon webbing legs will support 10,000 lb. and the nylon lift ring will support 40,000 lb. A modified 10,000 lb. ratchet buckle permits adjustment of each leg individually. The lift ring is bolted together permitting it or a leg strap to be changed in the field without sewing. The sling assembly, made up of nylon webbing 1¾-in. wide, weighs less than 30 lb.



General Logistics Division, Aeroquip Corp., 2929 Floyd St., Burbank.



Steel Baggage Conveyor

Baggage conveyor belt at Montreal's Dorval Airport is made of 24-in.-wide strip steel.

The .032-in.-thick steel belt is expected to outlast conventional belting and its smooth surface permits easy removal of luggage. Two V-ropes bonded to the underside of the 73-ft.-long belt run in grooved sheaves to the conveyor terminals to provide continuous true tracking.

Sandvik Steel, Inc., 1702 Nevins Rd., Fair Lawn, N. J.

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and now produces the

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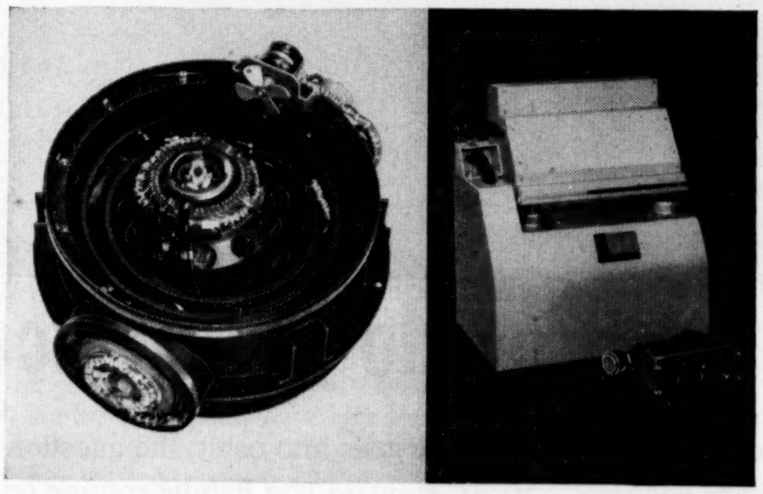
for the Lockheed F104J



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CAB Accident Investigation Report—Part II:

Tranquilizer Usage Linked to DC-3 Crash

(This is the concluding part of the CAB accident investigation report on the crash of a Piedmont Airlines Douglas DC-3 near Charlottesville, Va. on Oct. 30, 1959. The first part of the report, which appeared in the Aug. 14 issue of AVIATION WEEK, *contained the history of the aircraft and the flight, portions of the reports of witnesses, and a report on the aircraft's post-accident condition.)*

One witness who described the turn said that after the turn the diminishing engine sound stopped quickly but that she heard no sound like a crash.

Another, closer to the mountain, heard the aircraft proceed toward the mountain and at 2045 heard a sound like an explosion. Still another stated she had not heard the aircraft but did hear a sound like thunder of short duration. She placed the time after 2035 and before 2040.

ANALYSIS

Examination of the wreckage of N 55V revealed no evidence of malfunction or failure of the airframe or powerplants. There was no indication of an in-flight fire, all major components of the aircraft were located in the immediate crash zone, and it was clearly evident that both engines and propellers were capable of normal operation prior to impact. There was nothing found indicating that an emergency existed before the accident. These findings, reached by examination of the available physical evidence, were substantiated by the observations of Mr. Bradley.

For reasons hereinbefore enumerated, the Board is of the opinion that the soundpath developed from the description by several ground witnesses was made by Flight 349. From the soundpath information it is apparent the aircraft approached the accident location on a southwesterly course approximately parallel to the prescribed instrument approach path from the Rochelle intersection to the Charlottesville homer, but 8 to 11 mi. west of the normal track. The information shows that the southwesterly course was maintained to the Crozet area located 8 to 11 mi. abeam of the designated area for the instrument approach procedure turn. It is clearly apparent that in the Crozet area the flight executed a turn from its southwesterly heading to a northwesterly heading. By its amount and its north-south orientation, this turn was coincident with the turning portion of the procedure turn immediately prior to the inbound heading of 342 deg.

After the turn the flight flew northwest for, as near as can be determined, a distance of two to four miles and crashed against the side of Bucks Elbow Mountain. It crashed on approximately the heading of the inbound portion of the procedure turn with the landing gear extended. The elevation of the crash, however, was approximately 400 ft. below the altitude specified for the procedure turn.

From all this evidence it is most apparent to the Board that the accident took place while the general maneuvering requirements of the instrument approach were being flown 8 to 11 mi. west of the designated maneuvering area prescribed for the approach.

Because it was apparent that the flight flew a ground track well west of the desired track, a major investigatory effort was centered on the possibility that faulty operation of ground navigational and instrument approach facilities caused or contributed to the erroneous flightpath. This effort included exhaustive flight and ground checks. The company and the Air Carrier Branch of the FAA made several inspection flights, each using its respective aircraft. In addition, the Flight Inspection Branch of the FAA made evaluations of the airway and approach facilities using specific procedures and an aircraft equipped for the purpose. This work revealed normal operation of the facilities.

As part of this phase the Board called upon the Federal Communications Commission to assist. With special equipment and qualified personnel the FCC team made a comprehensive investigation covering a wide range of considerations relative to the performance, reliability, and installation of the homer beacons. Included were a search for an unauthorized homer rumored to be in operation, an investigation of electronic equipment used by local manufacturers, and an evaluation of signal strength within the operational range requirements specified for the homer beacons.

This phase of the investigation revealed no condition which would impair flight conformity along V-140 or the execution of a normal instrument approach on the homer facilities.

Navigation Equipment

As previously described, the airborne navigational equipment was determined by physical evidence to have been properly tuned for an instrument approach utilizing the ADF equipment on which the Charlottesville approach was based. Because of this it was of primary concern to the investigation whether or not the ADF cockpit presentation was accurate. Most important in this determination were the positions of the ADF loops relative to the crash heading and location. The extended bearings of the red and green ADF loop positions passed nearly through the location of the respective homer beacon to which each was tuned. Also, the angle formed between the bearings subtended an arc at the homers equal to the distance between them. The Board does not believe these loop positions to be a matter of coincidence but rather direct evidence the ADFs were functioning normally at the time of the accident. Furthermore, the elapsed time between reporting Rochelle to the crash apparently exceeded the normal elapsed time from Rochelle to the inbound heading of the procedure turn by several minutes. Believing the flight operated in instrument weather conditions and made the final turn abeam of the procedure turn area, it is probable the turn was started with reference to the ADF indications. The Board considers it improbable that the ADF presentation would be accurate in showing the aircraft abeam of the facilities and inaccurate shortly before this indication. It is equally improbable that such inaccuracy would be followed by an accurate presentation at the time of the crash.

Based on the work performed and the evidence found, it is the opinion of the Board that this accident occurred for operational reasons. Consequently, the Board sought a determination in this area which would account for the flightpath of the aircraft being parallel to, but 8 to 11 mi. west of, the proper track. It sought a situation which could develop easily and, because it is probable that Capt. Lavrinc was flying, one which escaped observation by Copilot Haley. It also sought a situation in which the precarious lateral error would not be readily detected as such by either pilot. Because of a number of unknown elements and the inherent intangibles of the operational situation, it is doubtful that any analysis can determine the sequence of events with complete definitiveness. Nevertheless, the Board believes it reached a determination which best satisfies the aforestated requisites and the known factors.

It is the opinion of the Board that the laterally erroneous flightpath developed from an initial navigational error at the Casanova omni. It is believed it occurred as an omission in that the flight did not turn in conformity with the V-140 airway from the inbound radial of 260 deg. to the outbound radial of 239 deg., a left turn of about 20 deg. It is believed that the flight continued on the 260-deg. radial until it reached the 335-deg. radial of the Gordonsville omni at a location approximately 13 mi. northwest of the Rochelle intersection. It is the Board's opinion that at this location, which was believed by the pilots to be Rochelle, the flight turned left to and flew the approximate heading indicated by the flight plan and log to be flown from Rochelle, 200 deg.

The Board has reached its opinion as to the sequence of events based upon several factors. The first was the results of an analytical time, distance, and groundspeed plot. It is probable that the flight flew about 15 min. after reporting Rochelle until it crashed. This time, being considerably longer than the time normally required to fly from Rochelle to the inbound heading of the procedure turn, shows a greater distance must have been flown. A plot of the probable flightpath in reverse was therefore prepared using the time flown, a reciprocal of the soundpath, and the estimated

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groundspeed of the DC-3. This showed that 15 min. before the accident the aircraft would have been over an area about 13 mi. northwest of Rochelle intersection.

The second phase of this work was a radius of action plot from the Casanova omni. Based on the elapsed time between the Casanova and Rochelle reports, 15 min., it was determined that the flight would have flown 33 mi. A line of position with a radius of 33 mi. from Casanova was found to intersect the initial plot at a location which was approximately 15 min. from the crash or again about 13 mi. northwest of Rochelle.

At the completion of this work two additional significant factors were apparent. The point of intersection of the plots was closely coincident with the 335-deg. radial of Gordonsville. Secondly, the heading to the location of intersecting plots from Casanova was the 260-deg. radial of Casanova and the same as the inbound radial to Casanova from Springfield.

Copilot's Duties

At Casanova, Copilot Haley made the position report and most probably recorded it in the flight plan and log. Thereafter he vould be expected to tune his omni set to he Gordonsville frequency and select the 35-deg. radial in order to identify the Rochelle intersection. Considering the small mount of turn required at this time, the irst actions could have diverted his attenion for the period during which the capain would normally have made the turn. Tuning his omni to Gordonsville, though ecessary, would also reduce his opportunity o observe by omni indications the relative osition of the aircraft to the course of the irway. Additionally, there was indication hat Capt. Lavrinc flew with a lower than verage level of instrument panel illuminaion. In the Board's opinion these factors re valid reasons in this instance for the opilot not having detected the navigational mission.

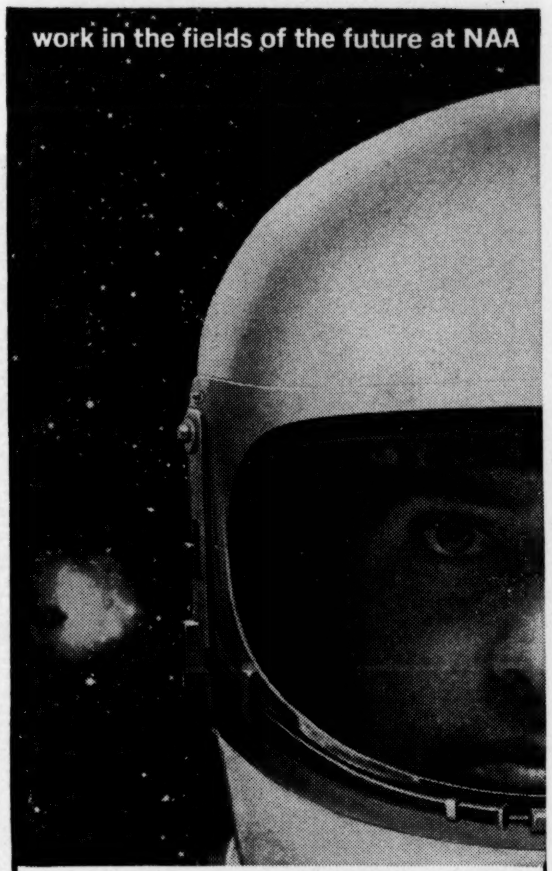
After reporting Rochelle and turning to he southwest heading it is likely that both ilots believed the aircraft was describing a roundpath west of, but only a short disnce west of, the normal track from Rohelle to the Charlottesville homer. It is he Board's opinion that at this time the ight was, in fact, 13 mi. northwest of ochelle. While this position was only two three miles farther than Rochelle from he Casanova omni, the position placed the uthwest course of the flight eight to nine iles west of the specified track. The locaon also positioned the flight about 10 mi. rther from the homer facilities than from he Rochelle intersection.

It is believed that this latter factor could ork to obscure the lateral error which isted during the southwest portion of the ightpath. The greater distance from the gnal source would reduce the angular disacement of the ADF presentation. Thus, the aircraft was positioned 10 mi. farther om the signal source than it was believed be by its pilots, the angular deflection the ADF presentation caused by the teral course error could be obscured conderably by the greater distance. For exmple, the ADF presentation 24 mi. from e signal source and eight to nine miles est of track is not alarmingly different than the presentation 12 mi. from the signal source and three miles west of the prescribed track. Similarly, the ADF presentation 19 mi. from the signal source and eight to nine miles west of track is not alarmingly different than the presentation seven miles from the signal source and three miles west of the track desired. In addition, as the flight progressed toward the facilities but from a greater distance than believed by the pilots, the increasing angular displacement of the ADF needles showing lateral error could be interpreted as a closure on the signal source. The Board believes the foregoing discussion to be a valid consideration in the reason that the pilots were not alerted early in the approach to the large lateral track error.

On the other hand, the Board is aware that as the flight proceeded on the southwest course the rate of progression of the ADF needles to the left 90-deg. abeam indication would have been much slower as the result of the greater distance and time to be flown. At the 90-deg. position the angular spread between the needles would have been much narrower 9 to 10 mi. west of the homers than three to four miles west of the homers. Further, 90 deg. abeam of the signal source, a 20-deg. relative bearing change on a flightpath three to four miles west of the homer, would take 30 to 40 sec. as contrasted to approximately 1½ min. on a flightpath about nine miles west of the homer. In addition, the ADF presentation during the period the flight turned from the southwest heading until it struck the mountain would have been incompatible with a close-in position. The Board believes that these factors should have served to alert an attentive pilot that the lateral course error was of considerable magnitude.

During the course of the investigation the aeronautical history of Capt. Lavrinc was reviewed. His training, qualifications, and proficiency reports were satisfactory. His history showed that he had progressed normally to captain and had served in that capacity since May, 1957. It also showed that he had flown in and out of Charlottesville and over the route involved for several years on a regular basis. Capt. Lavrinc had flown a total of 5,101 hr., of which 4,771 were in DC-3 aircraft.

To the Board there were numerous factors which were obviously inconsistent with Capt. Lavrinc's record. Some were: The apparent navigational omission, a nonadherence to precise tracking procedures, and a descent below the authorized procedure turn altitude. Others were: The failure to note that the time for station passage was in excess of that commensurate with a close-in position, and that ADF indications were not compatible with the normal procedure turn presentation. Still others were a failure to request the latest Charlottesville weather when the communicator did not furnish it, and not using the altimeter setting given in response to the inrange report. The Board believes these factors were not only inconsistent with Capt. Lavrinc's reputation as an exacting pilot but were indicative of a serious departure from the high standard and quality of performance expected during an instrument operation. Because of these factors a comprehensive investigation was made into the personal background of Capt. Lavrinc. This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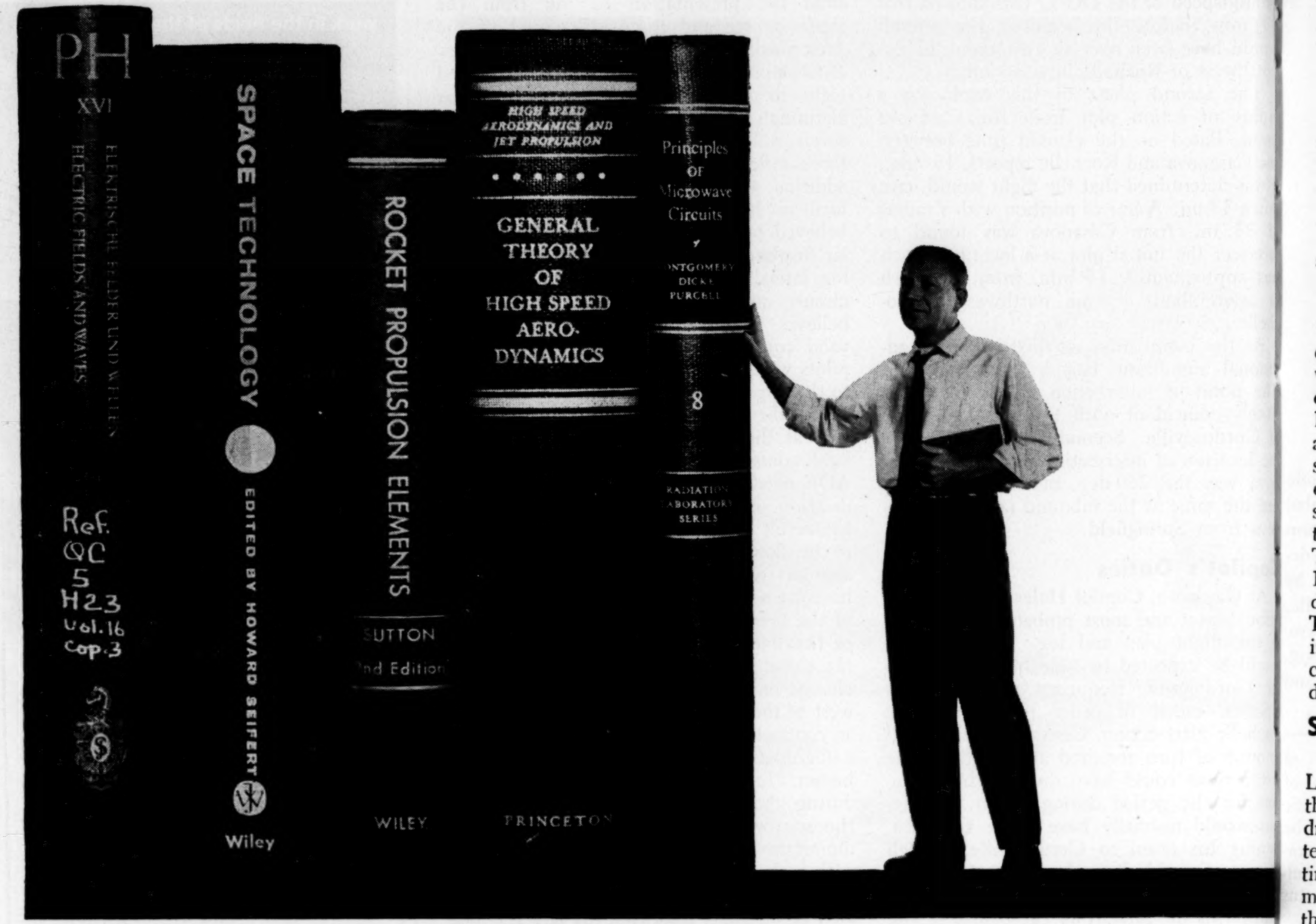
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was done to search for reasons which could seriously impair his normal piloting ability. During this work reasons were found which could result in his preoccupation.

Capt. Lavrinc had, for several years, been under severe emotional strain. The Board considers that disclosure of detailed information relating thereto would adversely affect the interests of certain persons and is not required in the interest of the public. A resume of the Board's significant findings and certain recommendations, however, are in the public interest and are set forth below.

Capt. Lavrinc received psychotherapy in 1953-1954; he obtained further psychiatric counseling in 1957; intensive psychotherapy was resumed in May, 1959, which he underwent several times a week thereafter; his last appointment was the night before the accident. This latter treatment involved the services of two psychiatrists. In the course of this treatment the first psychiatrist prescribed certain psychotropic drugs. After trials on Compazine, Prozine, Sparine, and Thorazine, Prozine was prescribed in August, 1959, in a dosage of three or four times daily and was reissued on Sept. 18, 1959. This prescription specified an amount which, if taken as directed would have been sufficient to last until two days before the accident.

Second Doctor

On Sept. 23, 1959, however, Capt. Lavrinc commenced psychotherapy under the second psychiatrist who prescribed no drugs. The Board has been unable to determine whether or not Capt. Lavrinc continued to take the medicine in the prescribed manner during the latter treatments, although there is evidence that he took the earlier trial prescriptions.

The Board has evaluated the background and history of Capt. Lavrinc, including data set forth above. In addition, it submitted all the available information covering Capt. Lavrinc to particularly qualified medical experts for evaluation as to its significance with respect to this accident.

The consensus is that Capt. Lavrinc was so heavily burdened with mental and emotional problems that he should have been relieved of the strain of flight duty while undergoing treatment for his condition. This condition was such that preoccupation with his problems could well have lowered his standard of performance during instrument flight. Furthermore, with respect to this accident the consensus is that the emotional and mental problems were of far greater importance in causing the preoccupation than would have the use of psychotropic medication.

The Board believes that the facts disclosed by this investigation demonstrate the adverse effects of serious emotional and mental stress on airman proficiency and performance. It further believes that the early recognition and correction of such conditions which might tend to impair an airman's proficiency and performance would be beneficial to flight safety. Accordingly, the Board recommends that the Federal Aviation Agency, appropriate segments of the aviation industry, and the medical profession initiate exploratory studies in this field.

The Board also considers that the investigation of this accident demonstrates the need for reexamination of the use of drugs which may affect the faculties of a flight crew member in any manner contrary to safety.

Since World War II there have been great advances in pharmacology and whole new families of drugs have become easily available to the public, either over the counter or by prescription. Since 1953-1954 one of the most significant advances has been in the field of psychopharmacology. There has been a proliferation of drugs which influence the state of mind, are employed in the treatment of mental disorders, or are used as psychic energizers. Within this group of drugs the so-called tranquilizers are being widely used by the public.

The basic question which the Board believes must be resolved, therefore, is how does the use of these drugs relate to the safety of flight. For example, within the framework of the present Civil Air Regulation covering the use of drugs[5], should these drugs be classified as ". . . drug which affects his (crew member) faculties in any manner contrary to safety . . ." The Board is of the opinion that the answer to the question is a qualified "yes." In great part

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[5] Section 43.45. *Use of Liquor, Narcotics, and Drugs.* No person shall pilot an aircraft or serve as a member of the crew while under the influence of intoxicating liquor or use any drug which affects his faculties in any manner contrary to safety. A pilot shall not permit any person to be carried in the aircraft who is obviously under the influence of intoxicating liquor or drugs, except a medical patient under proper care or in case of an emergency.

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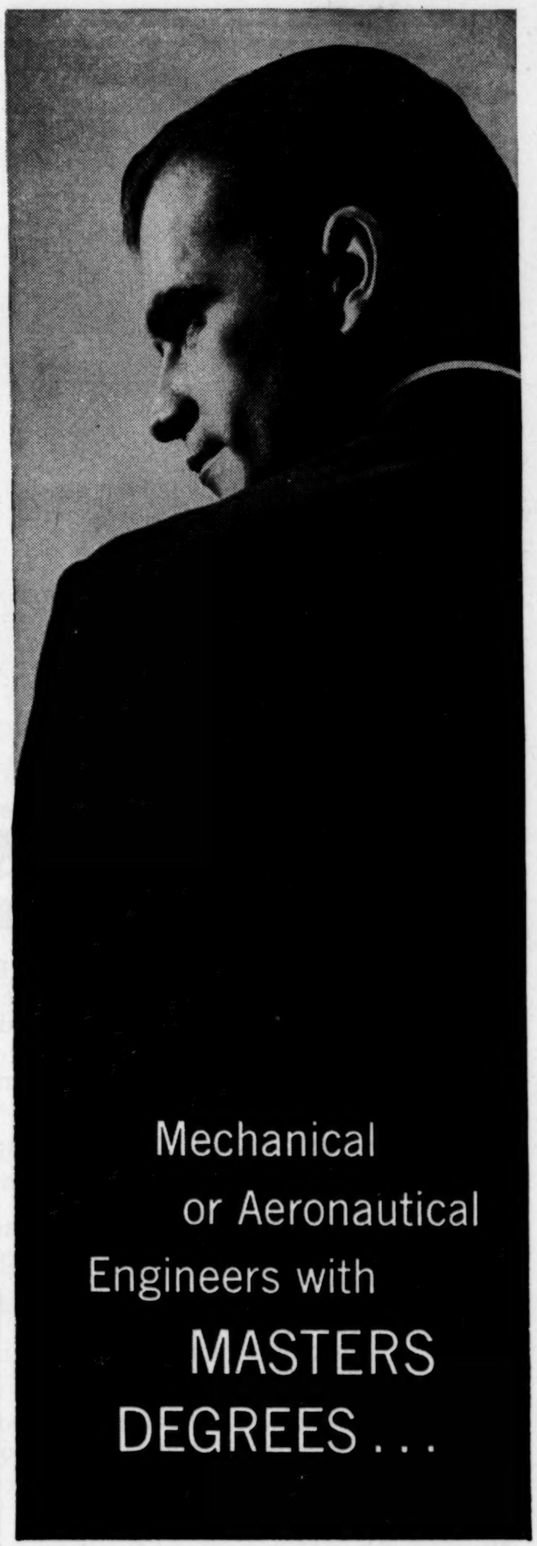

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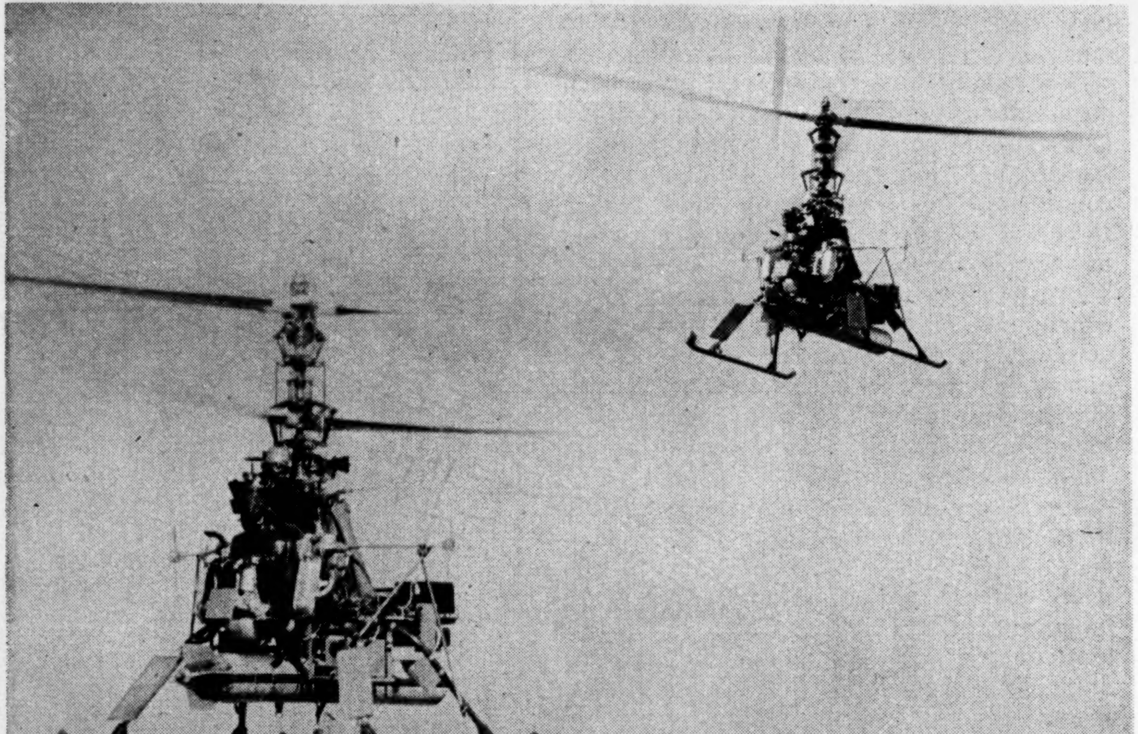

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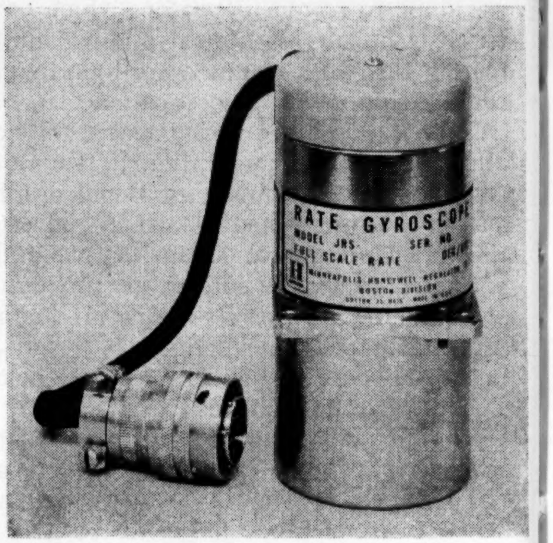

Rate Gyro

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this decision is reached from review of military research into the relationship of drugs to the flying profession. The basic conclusion derived from this research can be stated quite simply: If a flight crew member's personal situation demands tranquilizers he should be removed from flying status while on the drugs.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a navigational omission which resulted in a lateral course error that was not detected and corrected through precision instrument flying procedures.

A contributing factor to the accident may have been preoccupation of the captain resulting from mental stress.

By the Civil Aeronautics Board:

Alan S. Boyd, Chairman
Chan Gurney, Member
G. Joseph Minetti, Member
Whitney Gilliland, Member

Murphy, Vice Chairman, did not take part in the adoption of this report.

SUPPLEMENTAL DATA

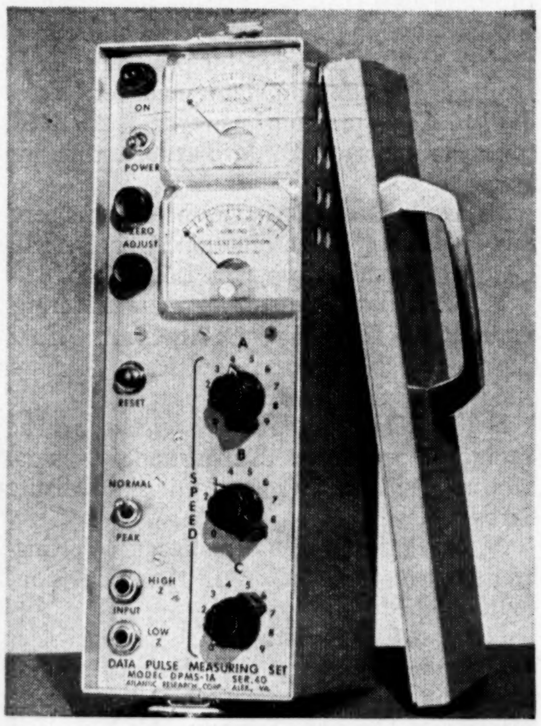
The Civil Aeronautics Board was notified of the accident shortly after the flight was presumed to have crashed. Board investigators were immediately dispatched to Charlottesville and participated in the search and rescue activity until the aircraft was located. Thereafter, an investigation was initiated and conducted in accordance with the provisions of Title VII of the Federal Aviation Act of 1958. A public hearing was held in conjunction with the investigation in Charlottesville, Va., Dec. 10-11, 1959.

Piedmont Airlines is the Airline Division of Piedmont Aviation, Inc. The company is incorporated in North Carolina with its principal offices in Winston-Salem, N. C. The Piedmont Airlines Division of the company was established in 1947. It operates under a currently effective certificate of public convenience and necessity issued to the company by the Civil Aeronautics Board and an air carrier operating certificate issued by the Federal Aviation Agency. These authorize the company to transport by air persons, property, and mail over various routes including the one involved in the accident.

Captain George Lavrinc, age 32, was employed by Piedmont Aviation Jan. 23, 1950. He was employed in the radio department and transferred to the Airline Division Nov. 24, 1951. He was promoted to reserve captain on May 1, 1957. Capt. Lavrinc held a valid FAA airline transport pilot certificate with a DC-3 aircraft rating. Company records showed he had flown 5,101 hr., of which 4,771 were in DC-3 aircraft. His last first-class medical was satisfactorily accomplished Oct. 13, 1959. His last semiannual proficiency flight check was satisfactorily accomplished May 26, 1959.

First Officer Bascom L. Haley, age 27, was employed by Piedmont Airlines on May 2, 1957. He held a valid FAA commercial pilot certificate with an instrument rating. According to company records he had accumulated 2,858 hr., of which 1,678 were in DC-3 aircraft. His last first-class medical examination was satisfactorily accomplished May 12, 1959.

DC-3, N 55V, was manufactured June 2, 1944, and procured by Piedmont Aviation on Jan. 14, 1955. It had been flown a total of 26,339 hr. The aircraft had been flown 83 hr. since the last No. 4 inspection. The engines were Pratt and Whitney, model R-1830-92, equipped with Hamilton Standard model 23E50 propellers.



Data Pulse Unit

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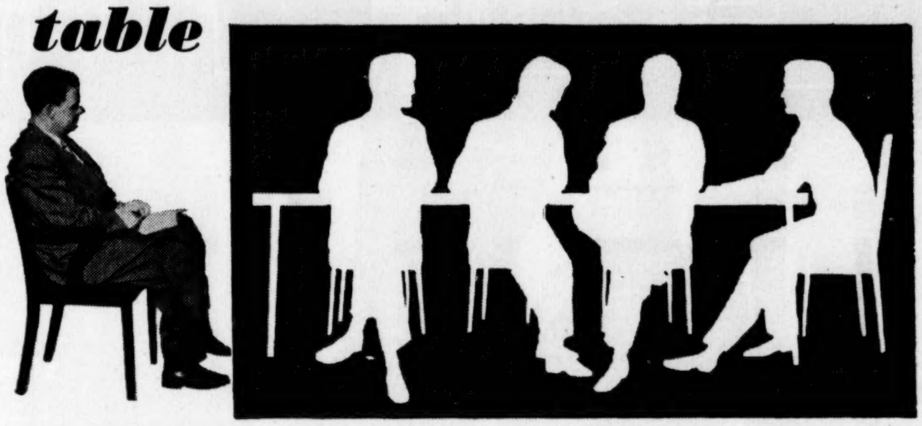

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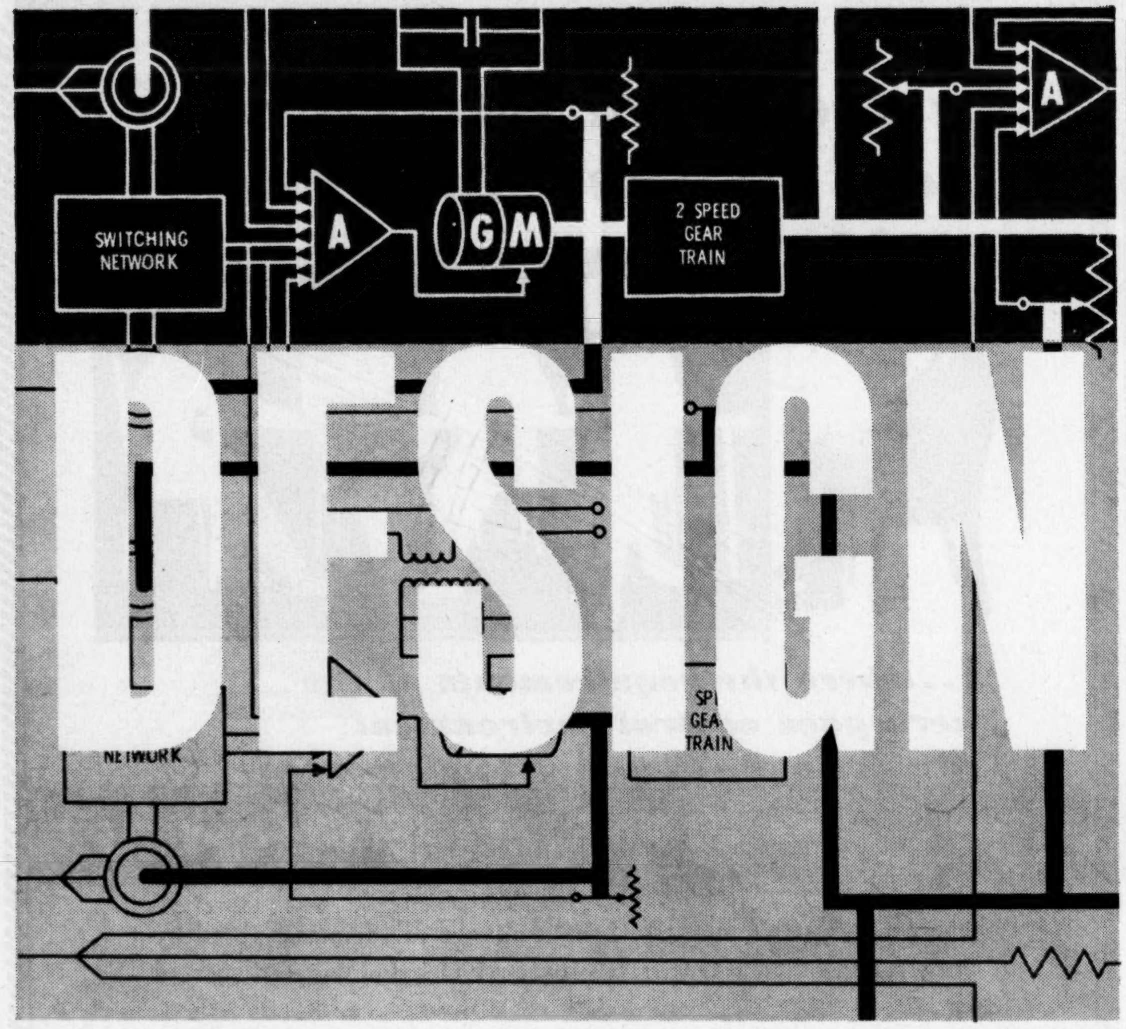

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WHO'S WHERE

(*Continued from page 23*)

Honors and Elections

D. R. Hankins, director of reservations and counter sales for Southern Airways, has been elected 1962 chairman of the reservations committee of the Air Traffic Conference of America, a division of the Air Transport Assn. of America, succeeding **Maury L. Perry,** director of reservations for United Air Lines. **Russ Pettite,** director of reservations for Trans World Airlines, was elected vice chairman.

Christopher S. Cockerell, inventor of the hovercraft and a director of Hovercraft Development, Ltd., has been presented with the Viva Shield for 1960 by the Worshipful Co. of Carmen, City of London. The award is made annually for the most outstanding transport improvement.

Changes

Robert N. Lesnick, director of engineering operations, Western Development Laboratories of Philco Corp., Palo Alto, Calif.

Donald D. Kirsch, manager-aerospace electronics marketing department, Waltham Laboratories, Sylvania Electronic Systems, a division of Sylvania Electric Products, Inc., Waltham, Mass.

Alfred C. Evans, director of research and development, Weston Instruments Division of Daystrom, Inc., Newark, N. J.

Bendix Mishawaka Division of The Bendix Corp., Mishawaka, Ind., has established the following positions for the development and production of Talos and Typhon missiles: **J. P. Field,** director of programs; **E. F. Lapham,** Typhon program manager; **T. S. Torian,** Talos program manager; **J. A. Reed,** contracts manager; **D. A. Tuttle,** estimating manager.

Louis O. Zuefle, manager of systems services, McDonnell Automation Center, McDonnell Aircraft Corp., St. Louis, Mo.

T. M. Hinds, director of manufacturing, Brand-Rex Division of American Enka Corp., Concord, Mass., and **R. J. Rodday,** director of marketing.

Dr. Arnold T. Nordsieck, head of the Technical Specialties Department, General Motors Defense Systems Division, Santa Barbara, Calif.

N. V. Petrou, general manager, Westinghouse Electric Corp.'s Air Arm Division, Baltimore, Md.

Harvey C. Griffith, Jr., manager-sales planning and promotion, Technical Products Operation of General Electric Co.'s Defense Electronics Division, Syracuse, N. Y..

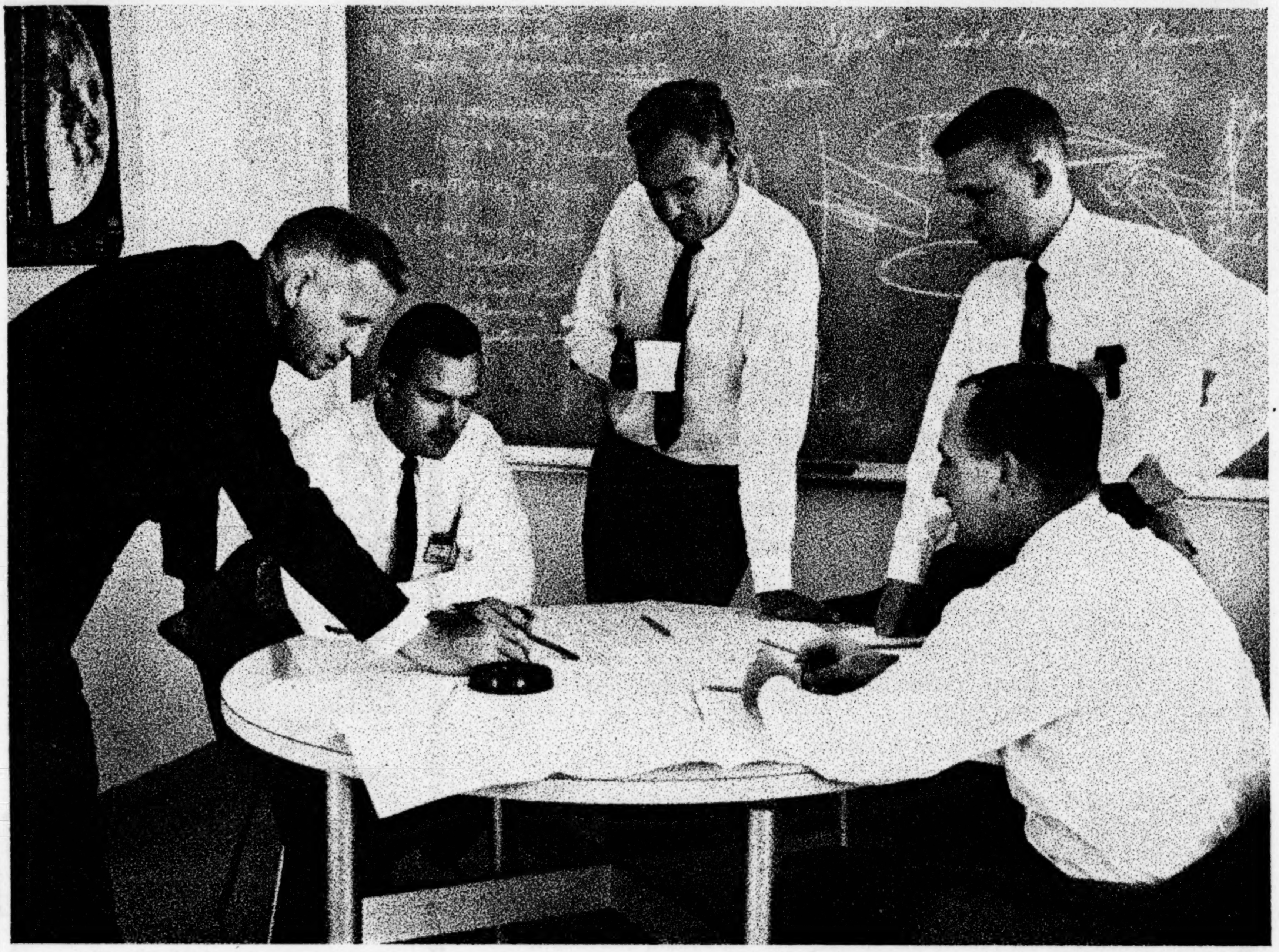
D. C. Wolford, director of technical operations, Temco International Corp., Washington, D. C.

William D. Hogan, manager of engineering services, Semiconductor Division, Sylvania Electric Products, Inc., Woburn, Mass.

George E. Chutka, manager-missile industry liaison, Minnesota Mining & Manufacturing Co., St. Paul, Minn.

Dale E. St. John, director of advanced development, communication and data systems, Arnoux Corp., Los Angeles, Calif.

Marcel Verrando, chief engineer, Trinity Equipment Corp., Cortland, N. Y.



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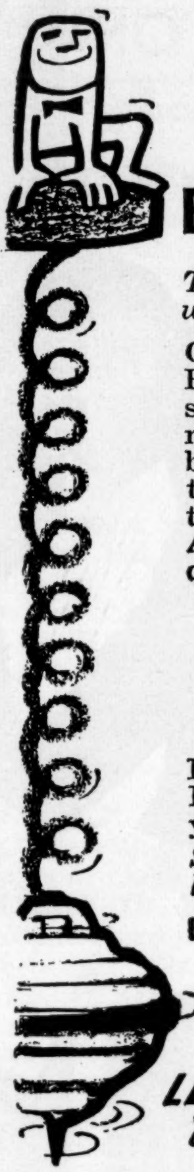

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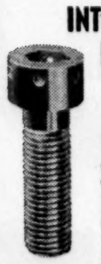

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LETTERS

Bounder Design

In a letter published in the July 31 issue of Aviation Week ("Bounder Design," p. 112) a reader noted the similarity of the Soviet Bounder bomber to a Convair design.

It might be interesting to compare the photograph of the model of the Convair supersonic transport proposal (AW July 7, p. 39) with those of the Bounder (pp. 69, 72, 73).

Of course, the Convair's newer design shows a more advanced state of the art, but the basic designs are too similar to be coincidentally so. Almost undoubtedly the Bounder should be tagged "Designed in the U.S.A."

P. W. Black
New York, N. Y.

Reference Aviation Week of Aug. 7, p. 72.

The caption indicates that the Bounder may also serve in the role of aerial tanker to the Beauty as well as other aircraft. As stated in the caption, one might believe that the refueling system is of the flying boom type as used by USAF SAC.

In reviewing Aviation Week of July 17, p. 26, top photo, the caption indicates that the Beauty has a retractable probe installed which would be compatible with the drogue and reel method of refueling. Further review of Bounder photos in both issues indicates to the writer that the installation on the Bounder is a drogue stowage fairing much the same as the type used on the U.S. Navy A3D tanker. An additional theory is that the pod on the Bounder may extend much the same as the Beech system now under development (AW Aug. 7, p. 82), eliminating the need for a drogue depressor, thereby keeping the receiver aircraft well below and out of the tanker's turbulence.

Frederick W. Burton
Field Service Representative
Flight Refueling, Inc.
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Sanford, Fla.

Nuclear Portent

While there are many areas in which the government has shirked its responsibility by failing to provide the American people with realistic facts concerning nuclear weapons, this is not the case regarding the effects of nuclear weapons.

Perhaps the most comprehensive summary of current knowledge on the effects of nuclear weapons is contained in an unclassified handbook published by the United States Atomic Energy Commission. This handbook, titled "The Effects of Nuclear Weapons," can be obtained from the United States Government Printing Office at a cost of $2.

This is one case in which the government should be congratulated, instead of chastised, for a job well done.

J. J. Siegel
Avco Research and Advanced
Development Division
Wilmington, Mass.

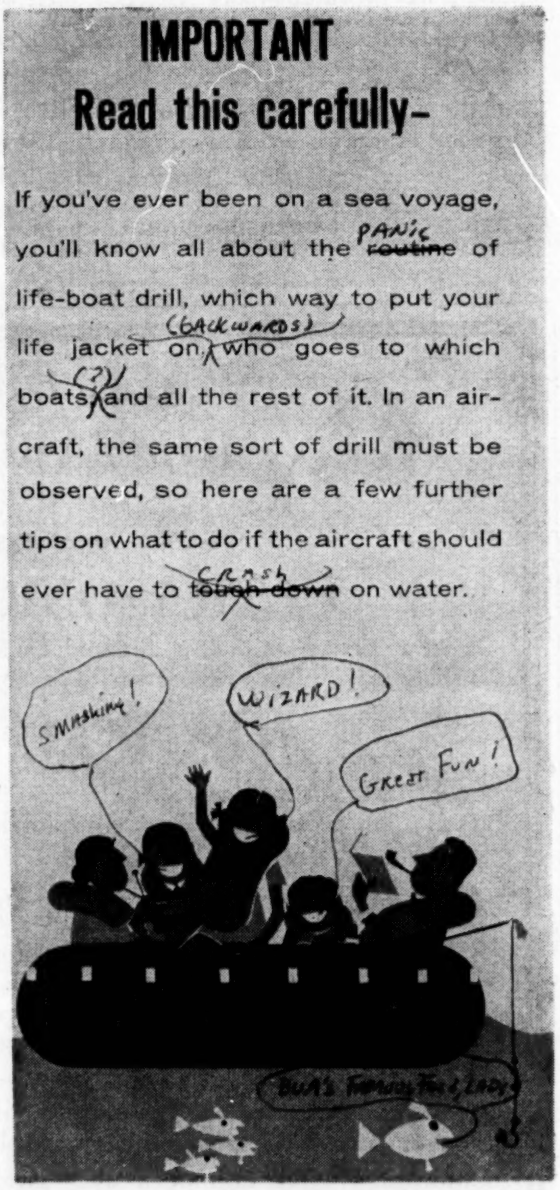
Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Red Rockets' Glare

Is it or is it not reasonable to assume that if a nation the size of Israel is capable of manufacturing and launching its Shavit Shtayim ionospheric rocket then certainly a country the size of Red China, committed as it is to world revolution and creeping expansionism and isolated by Western policymakers and Russian antagonisms, is well along the road toward nuclear rocketry?

I think it would be the crudest omission to assume that exhaustive research isn't going into the development of military rockets behind the bamboo curtain.

(Name Withheld by Request)



IMPORTANT

Read this carefully-

If you've ever been on a sea voyage, you'll know all about the PANIC ~~routine~~ of life-boat drill, which way to put your life jacket on (BACKWARDS) who goes to which boats (?) and all the rest of it. In an aircraft, the same sort of drill must be observed, so here are a few further tips on what to do if the aircraft should ever have to CRASH ~~touch down~~ on water.

LIGHT NOTE taken by an airline brochure writer turned into a challenge to an anonymous passenger's editing ability. The result was later found on board a British United Airways' Viscount by an Aviation Week correspondent. Further commentary in the booklet deals with illustrations of smiling passengers donning life jackets, described as "not to worry poses."

Seating Arrangement

Congratulations for highlighting a significant development for airline passenger safety ("Tri-Axial Airline Seat Limits Acceleration," AW July 24, p. 95). However, it is regrettable, indeed, that agencies such as the ALPA, the ATA, and certain parts of the AIA continue their negative thinking on rearward seating. They have been quick to minimize the validity of the data presented by Col. Stapp, et al. But these esteemed organizations have yet to state what proof is required for them to support rearward seating.

As an attendee at the June FAA meeting in which this subject was presented, there was one more point of interest. It was quite obvious that full advantage of recent seat design techniques, developed as a byproduct to space vehicles, has not been reflected in airline transport seat design or specifications. Apparently, these concepts won't be used, either, unless the airlines or the government insist upon it.

Tradition and the predominance of sales-oriented timidity are remarkable things. They can even cost unnecessary losses of life.

C. O. Miller
Dallas, Tex.

Et Tu 124

The caption to the admirable picture on p. 37 of your July 31 issue is perfectly correct except in a few minor respects:

The engines are not turbofans; they are straight jets.

The airplane is not a smaller version of the Tu-104; it is a larger version of the Tu-104 in that it has increased wing chord.

The bulges have nothing to do with area rule; they do not "probably carry fuel"; they certainly carry wheels.

The airplane is not a Tu-124, anyway; it is the new Tu-104E.

Heartiest congratulations on your Tushino photographic coverage, if not on its interpretation.

P. Riviere
London, England

I have often thought that your caption writers get carried away with little tidbits of information, but have always resisted the urge to write. However, the caption under the picture of the Soviet Tu-124 on p. 37 of the July 31 issue says in part: "Area rule bulges on the wing probably carry fuel." I doubt if area rule had anything to do with the design, and suggest the bulges probably carry the main landing gear just as they do in the Tu-104.

I have come to think of these caption bits as part of the personality of the magazine. They in no way detract from my long standing opinion that you have the finest aviation magazine anywhere.

W. J. Brandel, Jr.
Hyde Park, Mass.

(The airplane in question is clearly a Tu-104. Aviation Week *should have checked Russian identification of the photo as the Tu-124. The photo was not part of* Aviation Week's *Tushino coverage but a routine release—Ed.)*